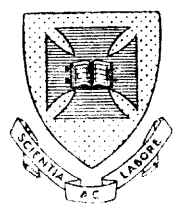


marks, Elizabeth

with the Compliments of the Author  
Elizabeth N. Marks  
769  
Dup.



# University of Queensland

## PAPERS

---

---

### DEPARTMENT OF BIOLOGY

Volume II

1949

Number 11

---

### Studies of Queensland Mosquitoes

Part IV.—Some Species of *Aedes* (Subgenus *Ochlerotatus*)

BY

ELIZABETH N. MARKS, M.Sc.

Price: Five Shillings

UNIVERSITY OF QUEENSLAND PRESS  
BRISBANE

30th SEPTEMBER, 1949

DEPARTMENT OF BIOLOGY

VOL. II.

1949.

NUMBER 11

STUDIES OF QUEENSLAND MOSQUITOES  
Part IV.—Some Species of *Aedes* (Subgenus *Ochlerotatus*)

*By*

ELIZABETH N. MARKS, M.Sc.

*University of Queensland*

UNIVERSITY OF QUEENSLAND PRESS  
BRISBANE

30th SEPTEMBER 1949



Printed by WATSON, FERGUSON & Co.  
Stanley Street, South Brisbane

# STUDIES OF QUEENSLAND MOSQUITOES.

## 4. SOME SPECIES OF *AÈDES* (SUBGENUS *OCHLEROTATUS*).

By ELIZABETH N. MARKS, M.Sc., Graduate Research Assistant,  
Mosquito Control Committee.

(WITH 16 TEXT FIGURES)

Eight species and one subspecies<sup>1</sup> of mosquitoes of the subgenus *Ochlerotatus* have been recorded from Queensland, viz.: *Aedes aculeatus* (Theo.), *Aedes burpengaryensis* (Theo.), *Aedes normanensis* (Taylor), *Aedes rubrithorax* (Macq.), *Aedes sagax* (Skuse), *Aedes theobaldi* (Taylor), *Aedes theobaldi eidsvoldensis* Mackerras, *Aedes vigilax* (Skuse) and *Aedes vittiger* (Skuse); to these are now added *Aedes pseudonormanensis* n. sp. and *Aedes perkinsi* n. sp.

In the present paper males of *aculeatus*, *normanensis* and *perkinsi* are described and also, for purposes of comparison, fresh descriptions and figures are given of ♂ genitalia of *theobaldi* and *pseudonormanensis* (previously figured for *normanensis*). In addition the male of a southern species, *Aedes stricklandi* (Edwards) is described for the first time. The larva of *pseudonormanensis* (previously figured for *normanensis*) is described and figured in more detail and descriptions are given of larvae of *aculeatus*, *normanensis*, *theobaldi* and *perkinsi*. Pupae of several species and the egg of *aculeatus* are also described and figured.

Edwards (1932) divided the subgenus *Ochlerotatus* into eight Groups, only three of which are represented in the Australasian Region. Of the Queensland species, he placed *aculeatus*, *normanensis*, *rubrithorax*, *theobaldi*, *eidsvoldensis* and *vigilax* in Group A. The same species comprise Mackerras' (1927) group of Australian *Ochlerotatus* with Neotropical affinities. Knight (1948) has found with the subgenus *Finlaya* that to facilitate the identification of species belonging to one of Edwards' large Groups, some system of subdivisions is needed. It seems probable that the Groups of *Ochlerotatus* will in the future be similarly subdivided, and it may therefore be useful to indicate the relationships of the species dealt with here. Distinguishing characters of Group A, as given by Edwards, include banded tarsi, lower mesepimeral bristles usually absent, ♂ genitalia with no definite apical lobe to the coxite and appendage of harpago straight and bristle-like. *Aculeatus* is an aberrant species, the small broad flat spindle-shaped scales on the head and mesonotum being at variance with the characters cited by Edwards for subgenus *Ochlerotatus*. ♂ Genitalia of *aculeatus* are at variance with the characters of Group A in that the harpago appendage is curved and flattened and produced along its crest into a row of filaments. In this character it resembles *vittiger*, but in other respects its affinities appear to be with Group A.

The adult characters of the remaining Australian species of Group A suggest that they are closely interrelated, but their larvae are of two very distinct types. In the *vigilax* subgroup, comprising *vigilax* and *rubrithorax*, the siphon shows no special modifications. In the *theobaldi* subgroup, which includes *theobaldi*, *normanensis*, *pseudonormanensis*, an unknown larva and presumably also *eidsvoldensis*<sup>2</sup> and which has all the characteristics of a superspecies, the chitinisation of the siphon does not extend to the base dorsally, the preapical seta on the ventral valve is very stout and forwardly curved and the tracheae are unusually narrow. Larvae of species in this subgroup have similar habits. When disturbed they dive rapidly to the bottom and lie motionless. Much of their feeding is done at the bottom,

---

<sup>1</sup>*A. theobaldi* form *eidsvoldensis* Mackerras is herein regarded as a subspecies.

<sup>2</sup>The life history of *eidsvoldensis* has not been worked out and there is no evidence to correlate with it the unknown larva of the subgroup.

lying on their backs with their mouths directed upwards, the rotation of the mouth-brushes bringing the usual current of water and food particles. When lying thus the siphon forms with the long axis of the abdomen an angle of approximately 90°. Definite observations have not been made, but it is suggested that the reduction of chitinisation dorsally would facilitate the siphon being bent back at such an angle, while the hook-like setae on the ventral valves would help to anchor the larva when feeding in this position. Perhaps the narrow tracheae are also associated with this feeding habit since, as Hopkins (1936) points out, the specific gravity of a larva is usually very close to that of water and whether it can remain at the bottom depends therefore on the amount of air in its tracheae.

In Group B Edwards placed provisionally three Australian species, *flavifrons*, *vittiger* and the southern species *Aedes camptorhynchus* (Thomson), stating that it was doubtful if they were closely connected with the Holarctic forms which comprise the majority of the Group. Characters of Group B include hind tarsi with basal bands on all segments, lower mesepimeral bristles present, ♂ coxite with distinct apical lobe, basal lobe variable, larva with 5-6 precratal tufts. The male of *perkinsi* lacks lower mesepimeral bristles, but a similar lack occurs in *flavifrons* (Mackerras, 1927). The larva of *perkinsi* has only 1-2 precratal tufts but *camptorhynchus* and *vittiger* also differ in this respect from the characters of the Group. ♂ genitalia of *perkinsi* closely resemble those of *camptorhynchus* and its affinities are with the 3 above-mentioned species, which Mackerras grouped as the Australian species of *Ochlerotatus* with Holarctic affinities and conspicuously banded tarsi.

The two remaining Queensland species, *burpengaryensis* and *sagax*, belong to Edwards' Group G, which includes also all Mackerras' group of Australian species of *Ochlerotatus* with Holarctic affinities and unbanded, or inconspicuously banded tarsi. Other characters of Group G include lower mesepimeral bristles present; ♂ coxite with distinct apical lobe, basal lobe various. Edwards included the dark legged Australian species in this Group since they did not differ conspicuously from northern forms. The placing of *stricklandi* in Group G is confirmed by characters of its ♂ genitalia.

### (1) *AÈDES* (*OCHLEROTATUS*) *ACULEATUS* (Theobald).

*Gilesia aculeata* Theobald, 1903, Mon. Cul., 3 : 233 ; Bancroft, 1908, Ann. Q'land. Mus., 8 : 29

*Ochlerotatus aculeatus* Edwards, 1912, Ann. Mag. Nat. Hist., (8), 9 : 523.

*Aedes* (*Ochlerotatus*) *aculeatus* Edwards, 1924, Bull. ent. Res., 14 : 373 ; Ferguson, 1926, 15th Rept. Microbiol. Lab., N.S.W., for 1924 : 189 ; Mackerras, 1927, Proc. Linn. Soc. N.S.W., 52 : 295.

*Type* : Originally described from 2 females from Mrs. Bell's Scrub, Deception Bay, Queensland, collected by Dr. Bancroft and deposited in the British Museum. A male from Dunwich, Stradbroke Island, Queensland, 29.xi.1943, L. J. Callaghan and E. N. Marks, has been designated the allotype of this species and deposited in the University of Queensland collection. The female is redescribed from a large series and the male, egg, larva and pupa are described for the first time.

*Distinctive Characters* : A large species with banded tarsi, dark scaled wings, and no lower mesepimeral bristles, being distinguished from other species of the subgenus *Ochlerotatus* by having the head and sides of the mesonotum clothed with small broad flat spindle-shaped scales. Such scaling on the vertex is at variance with the characters cited for the subgenus by Edwards (1932). ♂ Genitalia : Coxite without definite apical lobe; basal lobe plaque-like, bearing a patch of fine curved setae; numerous medially directed setae sternally; terminal

appendage  $\frac{1}{3}$  length of style; appendage of harpago curved and flattened and produced along its crest into a row of filaments.

Larva: Head setae B and C single, d 4-9 branched, well developed; lateral comb of 10-14 stout pointed spines, each with small lateral denticles and a fringe basally; siphonal index 2.5-3.0, pecten without detached teeth; saddle forming a complete ring and with pointed spicules apically, 4-6 precratal tufts; gills subequal, tapering, upper 2 x saddle.

*Description of Adult ♀:*

Wing length 4.5-6.1 mm.

*Head:* Integument brown, clothed with broad, flat, oval or spindle-shaped white or creamy scales; similar but usually smaller golden scales bordering the eyes and also extending between the eyes where, however, the scales may be narrower. Upright forked scales small and scattered anteriorly but larger and denser towards nape; they may all be creamy, or be dark laterally, or almost all dark. Vertical and ocular setae very short and fine, some longer ocular setae laterally. Tori ochraceous with some dark setae and small broad dark scales medially; first two or three flagellar segments of antenna with yellowish tinge, the first with some dark scales medially, remainder black; verticillate hairs sparse, black. Clypeus dark brown. Palpi  $\frac{1}{4}$ - $\frac{1}{3}$  length of proboscis, rather sparsely clothed with dark scales, the integument ochraceous or light brown except for dark tip; the antepenultimate segment is swollen and  $\frac{1}{2}$  length of penultimate, the apical segment being minute and inconspicuous. Proboscis  $1\frac{1}{3}$ - $1\frac{2}{3}$  length of fore femur, stout and clothed with dark scales; the integument of the basal  $\frac{2}{3}$  is usually a lighter brown than that of the apical  $\frac{1}{3}$ . Labella dark.

*Thorax:* Integument dark brown. Mesonotum clothed moderately densely with small broad, oval or spindle-shaped and narrow, almost straight scales. On the anterior half of the mesonotum the fossae are clothed with broad scales continuing as a narrower lateral border posteriorly to the wing roots; there is also a wide line of narrower spindle-shaped scales down the midline and some on either side of the prescutellar bare area. On either side of the midline are narrow scales which on the posterior half extend almost to the lateral margin. The scales are mainly creamy to pale golden with a varying admixture of dark scales on the fossae, around the prescutellar bare area and among the narrow scales. Mesonotal bristles short and fine, dark or golden; about 16 acrostichal, about 20 dorsocentral and about 18-24 prescutellar bristles, several of which are longer and stronger; there may also be some scattered small bristles in front of the prescutellar bare area and there are numerous fine dark bristles on the fossae and above the wing roots. Scutellum brown, clothed with broad and spindle-shaped creamy scales with occasionally a few narrow scales also; bristles brown, about 12-18 to mid lobe and 9-15 to lateral lobes. Metapostnotum brown, lighter along lateral margins.

*Pleura:* Extensively clothed with broad spindle-shaped and larger flat pale scales, the upper half being as uniformly scaled as the mesonotum. The scaling includes the posterior pronotum (on upper  $\frac{1}{2}$  of which there is a varying admixture of black spindle-shaped scales), anterior pronotum, propleuron, sub- and postspiracular areas, paratergite and upper  $\frac{2}{3}$  of mesepimeron. The sternopleuron may be almost completely clothed with scales, the upper  $\frac{1}{2}$  and lower posterior border being clothed with broad flat scales while anteriorly on the lower  $\frac{1}{2}$  there is a patch of narrow straight pale scales. Pleural bristles mostly golden; a large patch of 30 or more propleural, 8-19 posterior pronotal (in several rows), 7-18 postspiracular, about 18 prealar, about 15-22 upper and no lower mesepimeral bristles; there are 2-6 upper sternopleural bristles and may be none or 1-4 along posterior border of sternopleuron.

*Legs* : Stout, purplish black scaled, extensively mottled and with banded tarsi. Fore and mid coxae pale scaled or with some admixture of dark scales, hind coxae usually bare but sometimes with a few pale scales; trochanters pale scaled, usually with admixture of dark scales. Femora with dark apex; dark anteriorly with extensive mottling of pale scales tending to form an almost complete creamy preapical ring, particularly on the hind femur; dorsally may be mottled, but usually dark except for mottling at base and preapically; posteroventrally, entirely pale except at tip or hind femur may be dark on apical  $\frac{1}{3}$ - $\frac{1}{2}$  except for preapical pale ring. Tibiae with dark apex, mottled anterodorsally, dark ventrally; posteriorly fore tibia is pale, mid pale, mottled or dark, hind mottled or uniformly dark. Fore tarsal segment I varying from basal  $\frac{1}{2}$  pale, remainder dark or mottled, to almost entirely pale except for dark tip; segments II-IV dark with basal pale bands  $\frac{2}{5}$ - $\frac{1}{2}$  II,  $\frac{1}{2}$  III and  $\frac{1}{3}$ - $\frac{2}{3}$  IV; V all dark. Mid tarsal segment I varying from basal  $\frac{1}{6}$  pale anteriorly,  $\frac{2}{3}$  pale posteroventrally, remainder dark or mottled, to almost entirely pale except for slight mottling anteriorly and dark tip; segments II-IV dark with basal pale bands  $\frac{1}{3}$ - $\frac{1}{2}$  II,  $\frac{2}{5}$ - $\frac{1}{2}$  III,  $\frac{1}{2}$ - $\frac{3}{5}$  IV, V all dark. Hind tarsal segment I with basal  $\frac{1}{7}$ - $\frac{1}{5}$  pale, rest dark or mottled, or almost entirely pale except for slight mottling anteriorly and dark tip. Segments II-IV dark with basal pale bands  $\frac{1}{4}$ - $\frac{1}{3}$  II,  $\frac{1}{4}$ - $\frac{2}{5}$  III,  $\frac{1}{3}$ - $\frac{1}{2}$  IV, V entirely dark or rarely with one or two inconspicuous pale scales at base. Claws of all legs equal, stout and unidentate.

*Wings* : Dark scaled (in one specimen there were a couple of pale scales near the base of  $R_1$ ); plume scales on all veins moderately broadened; a slight clouding of the wing membrane over the cross veins and extending basally. Cell  $R_2$  from  $1\frac{2}{5}$  to just over twice length of its stem; cell  $M_1$  from slightly longer than, to  $1\frac{3}{4}$  length of its stem, its base slightly proximal to that of cell  $R_2$ ;  $r-m$  in line with, or its own length distal to base of  $M_{3+4}$  (varying from almost in line to  $\frac{2}{3}$  length distant in the two wings of one specimen). Halteres with pale stem and brown knob clothed with pale scales, often with some admixture of dark scales.

*Abdomen* : Integument brown clothed with purplish dark and pale creamy scales, with sparse golden setae laterally and apically on the tergites and sternites and some smaller setae scattered over the sternites. Tergite I with pale or mixed dark and pale scales medially; II-IV dark scaled with large lateral white patches which may reach to apex, and sometimes with some creamy scales along apical border, II with a few pale scales basally or a basal pale band, III and IV dark medially or with scattered pale scales basally or a basal pale band which may be produced medially and may cover basal  $\frac{2}{3}$  of IV; V-VII pale scaled, the scales not completely covering the brown integument, so that they present a mottled appearance, or V may have its apical  $\frac{1}{3}$  dark scaled sometimes with pale scales along the apical border, VI may also be dark scaled apically or preapically and there may be dark apical lateral patches on VII, or the dark scaling on these segments may be reduced to a slight mottling apically on V. Sternites pale scaled, III-VII may have dark mottling or bands or lateral patches apically or preapically. Segment VIII retracted, bare. Cerci long, dark.

Description based on 57 ♀ ♀ from South Queensland.

*Description of Adult ♂* :

The male differs from the female as follows :—

Wing length about 5.0-5.3 mm. There is a tuft of creamy vertical setae. Tori reddish brown; flagellar segments light brown with dense brown verticillate hairs, the two apical segments darker brown. Palpi  $1\frac{1}{5}$ - $1\frac{1}{3}$  length of proboscis, with integument of shaft pale except at tip and segments IV and V dark, V being slightly swollen; all segments clothed with sparse purplish scales; a tuft of long

golden hairs at apex of segment III, a slightly shorter tuft on IV and scattered short hairs on V. Proboscis  $1\frac{1}{4}$ – $1\frac{2}{3}$  length of fore femur, purplish scaled, integument pale about middle, labella dark, or with pale apex. Mesonotal scaling similar to, but rather sparser than that of female; 12–14 prescutellar bristles. The patch of narrow scales on the lower sternopleuron is reduced or absent; 2–9 postspiracular bristles; about 10–14 prealar; 1–4 upper sternopleural bristles and 8–14 long and several shorter bristles along posterior margin of sternopleuron; 8–14 upper mesepimeral bristles. Femora and tibiae are less extensively mottled than in female and there is no creamy preapical ring on the femora; there may be a few pale scales at base of mid and hind tarsal segment V. Claws of fore leg unequal, the anterior longer with a strong medial tooth and sometimes with a basal tooth also, the posterior shorter with a long basal tooth. On mid leg anterior claw is very long with a basal and medial tooth, posterior is shorter than on fore leg with a basal tooth. Hind claws smaller, equal, unidentate. Wings: Very scantily scaled; cell  $R_2$   $1$ – $1\frac{1}{3}$  times the length of its stem, cell  $M_1$   $\frac{2}{3}$ – $\frac{4}{5}$  length of its stem, its base well proximal to that of cell  $R_2$ ;  $r-m$   $\frac{1}{3}$ – $1$  times its own length distal to base of  $M_{3+4}$ . Knob of halteres dark scaled, usually with admixture of pale scales. Abdomen: Integument of tergites and sternites is pale on basal  $\frac{1}{3}$ – $\frac{3}{4}$  of each segment, dark apically; there are long golden setae laterally and apically and numerous shorter golden setae scattered over the segments. Tergite I with a few pale, or dark and pale scales medially, II–VII with rather sparse and scattered scaling, creamy on basal  $\frac{1}{2}$ – $\frac{2}{3}$ , purplish black on apical  $\frac{1}{3}$ – $\frac{1}{2}$  of sclerites. Sternite I bare, II may also be bare or with some pale scales, III–VII similar to tergites, or pale scaled with a few dark scales apically, segment VIII and the coxites have dark integument, VIII with some scattered pale scales and coxites dark scaled laterally with long golden medial bristles.

Described from 7 ♂♂ from Dunwich.

### ♂ Genitalia (Fig. 1)

Coxite with sparse dark scales laterally and sternally; about 3–3½ times as long as broad at base, tapering slightly on distal half, and with a longitudinal groove-like membranous area along the inner aspect. Lying in this groove is an extension of the lower tergal portion of the coxite is the basal lobe which bears a patch of about 30 fine curved setae, with shorter straight setae tergally; the lobe also has a strong connection with the base of the harpago, as on dissection of the genitalia it tends to remain attached to the harpago rather than to the coxite. The coxite has no apical lobe but preapically on the tergal side of the groove there is a single stout medially directed seta flanked by a few short setae, and on the sternal side of the groove there are very numerous long medially directed setae in several rows running from base to apex of coxite. Tergally the coxite bears numerous fine setae, laterally there are many long setae and sternally some scattered setae. Style about  $\frac{2}{3}$  length of coxite, apically curved and tapering, finely pilose, with 4–5 short fine preapical setae; terminal appendage  $\frac{1}{3}$  length of style, short and straight with blunt grooved tip. Harpago long, stout, pilose basally,  $\frac{1}{3}$ – $\frac{2}{5}$  length of coxite with 1–3 short setae near base; appendage lightly chitinised, as wide as and about  $\frac{2}{5}$  length of harpago, and slightly curved and tapering distally to a bluntly pointed tip; along its crest the appendage is produced into a row of about 10–19 single, bifid, or sometimes trifid filaments, several of which may be fused together at their base, their length being about twice the width of the appendage. Paraproct with a single tooth, sometimes with 1–2 poorly developed additional teeth. Phallosome broad, simple. Lobes of IXth tergite with 6–10 setae; IXth sternite with 6–10 setae.



FIG. 1—♂ genitalia of *Aedes aculeatus* Theobald, x 127.

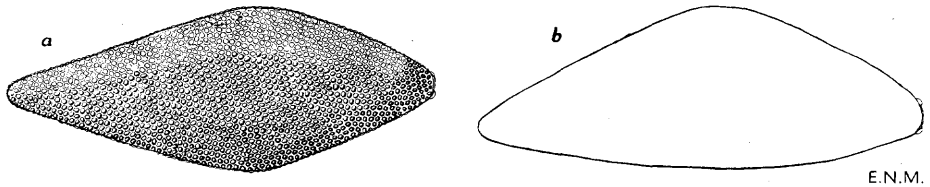
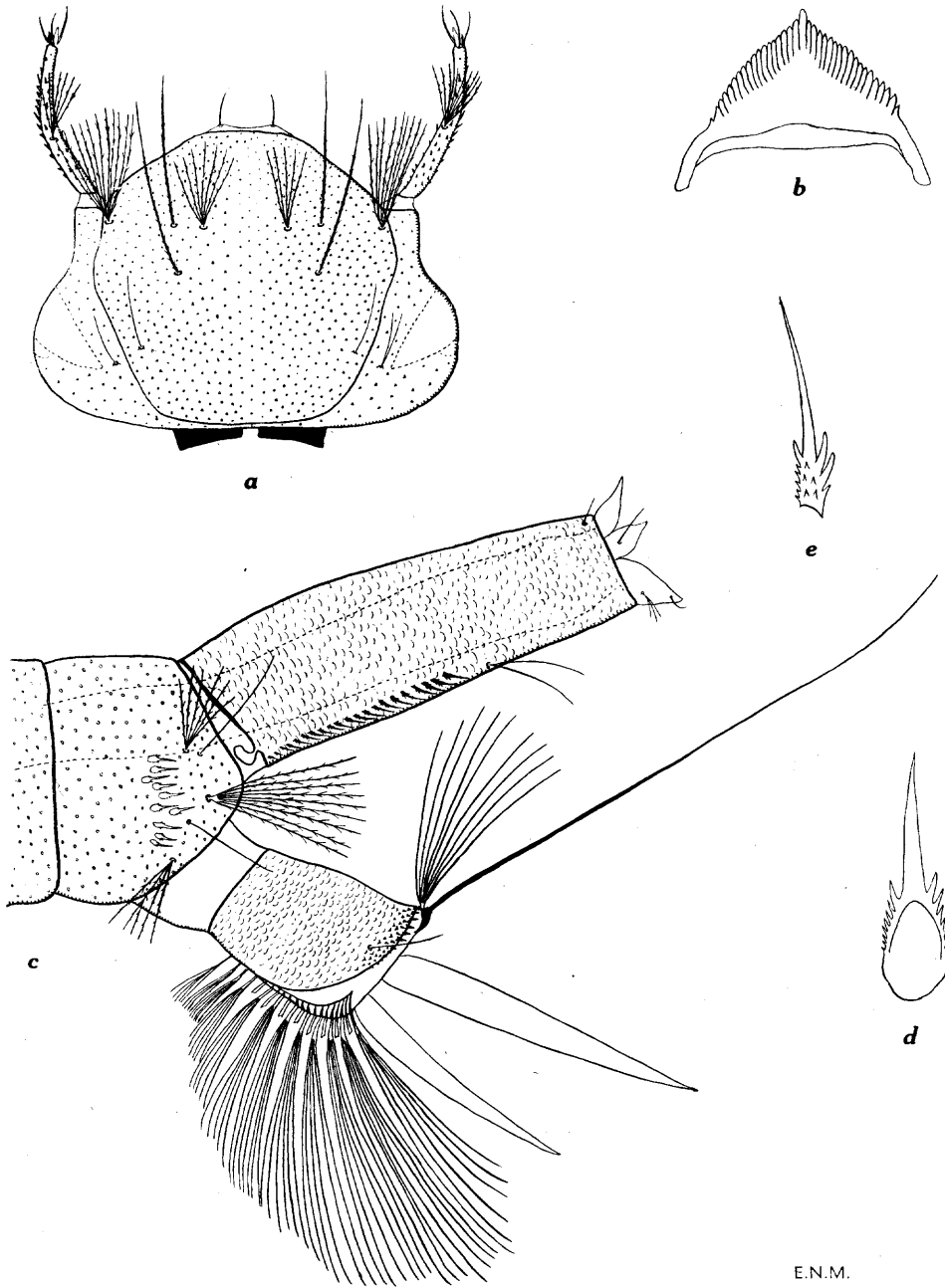


FIG. 2—Egg of *Aedes aculeatus* Theobald, x 63. *a*, showing sculpture; *b*, showing flattening of one side.

*Description of Egg:* (Fig. 2)

Length approximately 0.9 mm., greatest width 0.38 mm. The egg is black, fusiform, slightly flattened on one side, its widest diameter slightly nearer to the micropylar end, the ends roundedly pointed. The sculpture is hexagonal, fine and uniform. Freshly laid eggs may lie flat on the surface of the water, in groups, with no particular long side uppermost.



E.N.M.

FIG. 3.—Larva of *Aedes aculeatus* Theobald. *a*, head; *b*, mentum; *c*, terminal segments; *d*, lateral comb tooth; *e*, pecten tooth. (*a* and *c*, x 38; *b*, x 145; *d* and *e*, x 290).

*Description of Larva*: (Fig. 3)

Length about 7.5–11.0 mm. Colour dark greyish brown with dark brown head, siphon and saddle. The head capsule is studded with small heavily chitinised

tubercles. The integument of thorax and abdomen is studded with similar but lightly chitinised tubercles which become more flattened and plaque-like on the posterior segments. The surface of siphon and saddle is produced into a series of short chitinous ridges giving the appearance of overlapping scales.

*Head* :  $\frac{5}{7}$ - times as long as broad. Antenna a little more than  $\frac{1}{2}$  length of head, 7-8 times as long as broad at base, slightly curved and tapering, clothed with numerous stout spicules, those just beyond the tuft being the longest. Tuft 5-9 branched, shortly plumose, about  $\frac{1}{2}$  length of antenna and arising at  $\frac{1}{3}$ - $\frac{1}{2}$  from base; terminal and subterminal setae arising close together at apex. Clypeal spines fine, pointed, slightly curved and may be finely frayed. Seta A 7-12 branched, shortly plumose,  $\frac{2}{5}$  length of antenna and arising a little behind its base; B single, frayed or shortly plumose, equal in length to antenna, arising level with A and half way between it and mid line; C similar to but slightly longer than B, rarely bifid, arising a short distance from and directly behind, or slightly medial to B; d 4-9 branched, shortly plumose, about  $\frac{1}{2}$  length of B, arising medial to and in line with, or slightly behind B; e long, fine, single, simple or rarely bifid; f 1-3 branched, simple, e and f each arising from a raised boss. Mentum triangular with medial tooth and 15-18 slightly smaller, even, close set lateral teeth.

*Thorax* : Base of metapleural setae with one prominent and several shorter spines.

*Abdomen* : Two pairs of long finely frayed lateral setae on segments I and II, the upper bifid, the lower bifid on segment I, 2-5 branched on segment II, both upper and lower arising from the same chitinised boss; one pair of similar bifid setae on segments III-VI, rarely trifold on III.

8th Segment : Lateral comb one or two uneven rows of 10-14 stout tapering pointed spines, each with a broad base which bears one or more small pointed lateral denticles grading into a basal fringe. On one specimen there were in addition, at the base of the comb, 5 smaller spines  $\frac{1}{3}$ - $\frac{1}{2}$  the size of the main group. First pentad seta 5-8 branched, shortly plumose; second and fourth long, single, simple; third 7-12 branched, plumose; fifth 4-6 branched, some of the branches sometimes subdividing into 2 or 3, shortly plumose.

Siphon : Index 2.5-3.0, slightly tapering. Pecten extending over approximately  $\frac{1}{2}$  length of siphon, consisting of 17-24 evenly spaced pointed spines, each bearing bilaterally near its base 2-4 prominent and numerous shorter denticles. The spines are evenly sized or 3-5 of the most basal may be smaller. Subventral tuft 2-4 branched, simple, arising a short distance beyond end of pecten. Acus present.

Anal segment : Saddle forming a complete ring, with several rows of stout pointed spicules apically. Lateral seta single, simple,  $\frac{1}{3}$  length of saddle. Dorsal subcaudal setae simple, upper 8-13 branched, about  $1\frac{1}{2}$  times length of saddle; lower single, three times length of upper. Ventral brush of 20-23 multiple tufts, each with 6-10 branches, arising from a grid, except the basal 4-6 which are precratal and of which 1-4 may arise from the ventral surface of the saddle. Gills long, slender, tapering and pointed, subequal, the upper about 2 x saddle, the lower slightly shorter.

Description based on 17 specimens from Dunwich, Queensland, 8 pelts (25.xi.1943) and 1 pelt and 8 whole larvae (1.iii.1946).

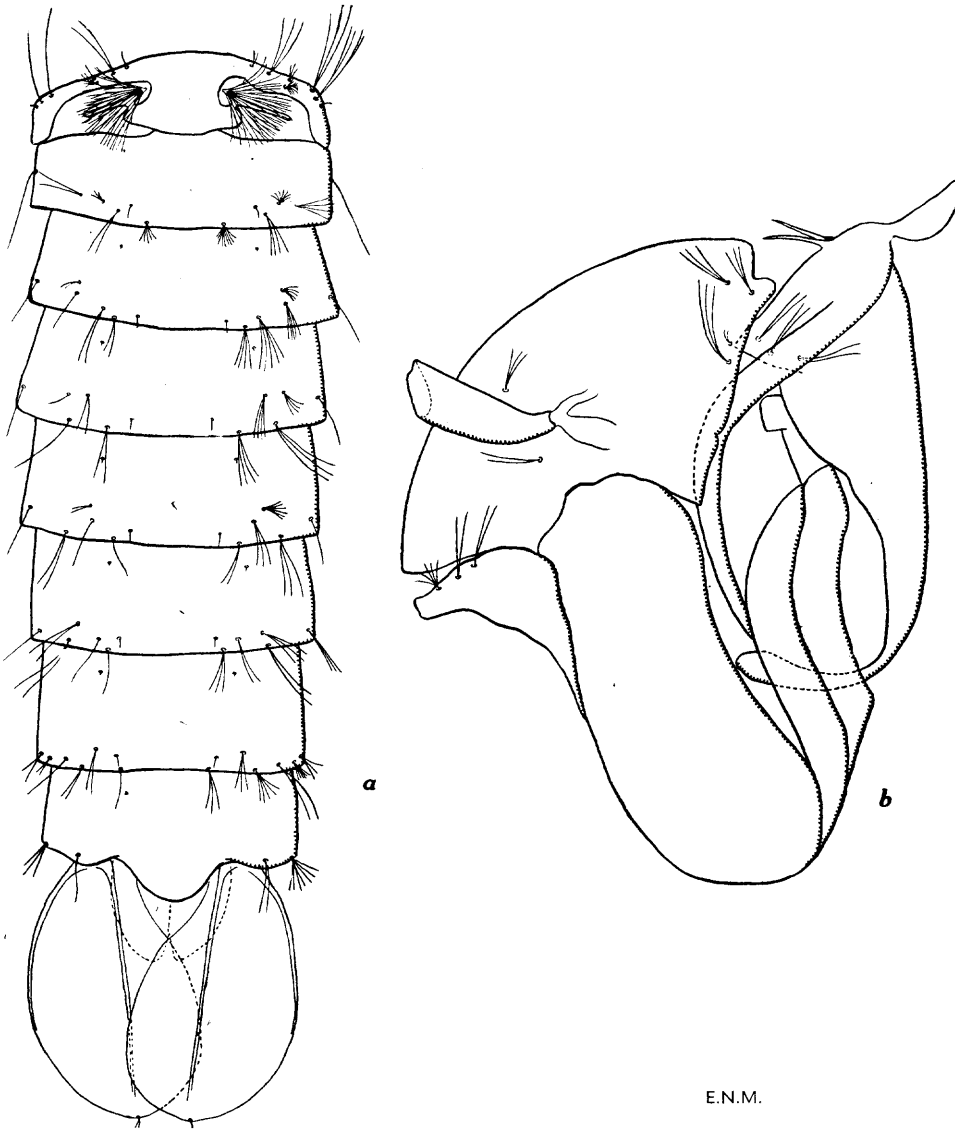


FIG. 4.—Pupal pelt of *Aedes aculeatus* Theobald, x 25. a, abdomen (dorsal view); b, cephalothorax.

*Description of Pupa* : (Fig. 4)

General coloration brown.

*Cephalothorax* : Pigmentation darker behind trumpets and on metapostnotum. Trumpet evenly pigmented, moderately long (about  $3-3\frac{1}{2}$  times as long as its greatest width), cylindrical, narrowing at base; opening oblique, ratio of meatus to whole 1 : 1.2-1.3; apical notch shallow.

*Abdomen* : Pigmentation slightly darker medially at bases of segments I-VI or VII. Float setae dendritic with about 15-30 branches. Some of longer abdominal setae may be finely frayed. Lateral seta of segment VIII short, plumose, 3-7 branched. Paddles oval (breadth index 1.2-1.7) with finely denticulate margin and fairly rounded apex; buttress and midrib well developed, paddle seta short, single or bifid.

Description based on 10 pupal pelts from Dunwich (25.xi.1943).

*Biology* : Only one breeding place of *aculeatus* has so far been located, this being in the area known as the Two Mile Scrub about two miles north of Dunwich Post Office on Stradbroke Island. The island is formed mainly of high timbered sandhills and a narrow strip of freshwater swamps occurs between the sandhills and the shores of Moreton Bay. These are mainly fairly open teatree and sedge swamps, but at the Two Mile a fairly restricted area is overgrown with tall trees, vines, pandanus, abundant ground orchids, lantana and other dense undergrowth. The soil is moist and peaty with numerous shallow depressions which are filled by heavy rain, though during a prolonged wet period the whole area becomes covered with water to a depth of about 1 foot. *Aculeatus* has been found breeding in these shallow depressions, in pools about 12-20 sq. ft. in surface area, 4-6 inches deep, containing many fallen leaves and some sedges, the water being clear, fresh and dark brown in colour.

The species was first located in the area by Mr. L. J. Callaghan on 3rd November, 1943, when adults were plentiful biting about dusk but, though pools were present, no mosquito larvae could be found. On this date *aculeatus* adults were also taken biting in a teatree swamp and an open heath swamp  $\frac{1}{2}$ -1 mile distant from the Two Mile Scrub. During the following three weeks the principal falls of rain recorded at Dunwich were 40 pts. on 5th, 87 pts. on 16th, 276 pts. on 18th, and 93 pts. on 22nd. The Two Mile Scrub was visited on 25th November and in one of the depressions described above were found very numerous pupae and apparently recently cast larval skins of *aculeatus*, though no larvae were found. There could be no doubt of the correlation as the only other species of comparable size bred from this collection were small numbers of *Aedes alternans* (Westw.) and *A. vittiger*. Other species bred from pools in this area were *A. rubrithorax*, *Aedes similis* (Theo.), *Aedes funereus* (Theo.), and *Aedes alboannulatus* (Macq.). From the *aculeatus* pupae collected, adults emerged in 2-3 days, the majority of males emerging a day earlier than the females. From 25th-29th November, adults of *aculeatus* were numerous biting in the Two Mile Scrub but were not encountered elsewhere. When the breeding place was examined on 29th November, only *Culex* spp. larvae were present. Some debris was taken from the edge of the pool and placed in water in the laboratory to test for presence of eggs, but no larvae bred out.

The breeding place was again visited on 27th February, 1946, when the depressions held no water, though the soil was damp. Some surface debris was collected and placed in water but no larvae bred out. The depressions were filled by rain on 28th February. Larvae of *aculeatus* were presented on 1st March and changed from 3rd to 4th instar on 4th March; of specimens collected on 4th, one pupated on 9th March. During this period adult *aculeatus* were moderately numerous biting in the Two Mile Scrub but again were not encountered elsewhere.

From the foregoing records it appears that the period covering the life history of *aculeatus* from the hatching of the egg to the emergence of the adult is probably about 10-11 days.

The breeding place was visited also on 28th September, 1947, and on 26th March and 21st August, 1948, but each time the area was under water and no larvae or adults were observed.

An adult female captured biting on 2nd March, 1946, was allowed to take a full blood meal and confined in a glass jar over damp cotton wool. Oviposition took place some time between 6th and 8th March, 20 eggs being laid. Some of these were placed in water, others dried and submerged several weeks later, but in no case did hatching occur.

*Habits*: Theobald (1903) records Bancroft's note that specimens of *aculeatus* flew down from the trees to bite; this was observed also at Dunwich. The females bite man readily and are very persistent in their attempts to bite but appear to have great difficulty in inserting the mouthparts; once these are inserted it is difficult to persuade them to relinquish their hold before they are fully engorged. They seem to have a special predilection for burrowing into their victim's hair. They are large and rather clumsy and seem fearless but stupid, lacking the alertness of smaller species. When fully engorged they are often too heavy to fly, and glide to the ground.

Although observations at Dunwich would suggest that this species does not travel far from its breeding places, an engorged female was found in a mosquito net on Wickham Terrace, almost in the heart of the city of Brisbane and probably at least five miles from any area where it might be thought likely to breed.

*Distribution*: The type specimens were from Deception Bay (T. L. Bancroft, captured in May). Specimens have been examined from the following localities in south coastal Queensland, both north and south of the type locality: Tewantin, 1 ♀ (G. Foley, 2.xii.1943); Mountain Creek, Buderim Mt., 1 ♀ (J. L. Wassell, 14.iii.1945); Brisbane, 2 ♀ ♀ (F. A. Perkins, 18.ii.1942; E. R. B. Marks, 7.ii.1947); Dunwich, Stradbroke Is., 5 ♀ ♀ (L. J. Callaghan, 3.xi.1943), 44 ♀ ♀, 7 ♂ ♂, larval pelts (L. J. Callaghan and E. N. Marks, 25-29.xi.1943), 4 ♀ ♀, larvae (E. N. Marks, 27.ii. and 2.iii.1946).

Ferguson (1926) records this species from Port Macquarie, N.S.W.

## (2) *AÈDES* (*OCHLEROTATUS*) *THEOBALDI* (Taylor).

*Grabhamia flavifrons* Theobald (*nec* Skuse), 1907, *Mon. Cul.*, 4: 304; Bancroft, 1908, *Ann. Q'land. Mus.*, 8: 30.

*Grabhamia theobaldi* Taylor, 1914 *b*, *Proc. Linn. Soc. N.S.W.*, 38: 751; 1919, *ibid*, 43: 832.

*Aedes* (*Ochlerotatus*) *theobaldi* Edwards, 1924, *Bull. ent. Res.*, 14: 375; Ferguson, 1926, 15th Rept. Microbiol. Lab., N.S.W., for 1924: 189; Mackerras, 1927, *Proc. Linn. Soc. N.S.W.*, 52: 295.

*Type*: A female<sup>1</sup> from South Queensland collected by Dr. Bancroft in December and deposited in the British Museum. Theobald (1907) redescribed *Grabhamia flavifrons* Skuse from this specimen. Taylor (1914 *b*) compared a similar Brisbane specimen with the type of *Culex flavifrons* Skuse and pointed out that it represented a distinct species which he named *Grabhamia theobaldi*. Mackerras (1927) designated an allotype ♂ from Eidsvold (Mackerras, 13.x.1926) which is in the Macleay Museum, University of Sydney.

<sup>1</sup> Whilst working on the British Museum collection (21 . iii, 1949), found this specimen and have marked it as the type of *Aedes theobaldi* (Taylor).—E.N.M.

*Distinctive Characters*: A medium sized species (wing length 3.2–4.7 mm. in specimens examined), distinguished by scaling of wing and abdomen. ♀ — Palpi with white scales medially and at apex, and sometimes with some mottling also. Basal  $\frac{2}{3}$ – $\frac{3}{4}$  of proboscis pale scaled beneath except for basal dark or mottled ring, extensively mottled above. Mesonotum clothed with narrow curved golden and creamy scales, usually with some admixture of bronzy black scales on the fossae and in the mid line; occasionally the dark scales predominate. Femora and tibiae moderately to extensively mottled with pale scales, mottling on hind tarsal segment I also; hind tarsal segments I–IV or V with basal white bands, covering not more than  $\frac{1}{3}$  IV and  $\frac{2}{5}$  V. Wing dark scaled with extensive mottling of white scales, which includes both squame and plume scales, on all veins. The plume scales are very broad and square tipped (about 3–3 $\frac{1}{2}$  times as long as broad) but may be narrower on  $R_2$  and  $R_3$ . Abdominal tergites II–VI with straight or rounded broad basal white bands or medial patches, never produced into triangles posteriorly, the dark scaling often extensively mottled with white on all segments or on VI and VII only. If there is no mottling there are usually some pale scales along the apical borders of the tergites; rarely these are found only on V and VI.

♂ — Wing with a few scattered broad white scales, more numerous and broader than in ♂♂ of *normanensis* and *pseudonormanensis*. Genitalia: Coxite with elongate apical lobe bearing very numerous setae; prominent basal lobe uniformly clothed with fine setae. Appendage of harpago slender, angled at  $\frac{2}{3}$  its length, the angle produced into a prominent pointed retrorse projection.

Larva: Antenna concolorous. Head seta B single, C bifid, d very small. Submedian prothoracic group without prominent base; the anterior seta 1–3 branched,  $\frac{1}{2}$  the length of the single medial; posterior seta single. Lateral comb of 16–24 pointed spines, coarsely fringed at base; fourth pentad seta single. Siphon with chitinisation not extending to base dorsally, index 3.3–3.9. Pecten of 9–15 spines extending  $\frac{1}{4}$  length of siphon; small pointed spicules at apex of saddle.

♂ *Genitalia*: (Fig. 5)

Coxite with mottled dark and pale scales laterally and sternally, about 4 times as long as mid width with a membranous area along its inner aspect, tergal to which are a prominent basal lobe and an elongate apical lobe. The latter bears very numerous long, straight, medially directed setae. The basal lobe broadens apically and is densely clothed with fine setae, those along the apical margin showing no special modification. Tergally the coxite bears scattered long setae, with some short setae near its base. Laterally and sternally it bears numerous long setae with, sternally, several very long ones towards apex, and some short setae at base. Style finely pilose,  $\frac{2}{3}$  length of coxite, narrow at base, widening medially, with apical  $\frac{1}{4}$  slender, curved and tapering; terminal appendage  $\frac{1}{3}$  length of style, slender and slightly curved. Harpago short, pilose, with a fine seta on its inner side; appendage longer than harpago, slender, sharply angled at  $\frac{2}{3}$  its length, the apical portion slightly broadened and tapering to a fine point, 3 times as long as the pointed retrorse projection into which the angle is produced. Paraproct with a single tooth. Phallosome simple, oval. Lobes of IXth tergite with 4–5 setae; IXth sternite with 4 setae.

*Description of Larva*: (Fig. 6)

Length about 6.5–7.3 mm. A pale larva with light brown head, siphon and saddle.

*Head*:  $\frac{2}{3}$  as long as broad. Antenna uniform brown, about  $\frac{2}{3}$  length of head and 8–10 times as long as broad at base, slightly curved and tapering, clothed with spicules; tuft 4–7 branched, finely frayed, about  $\frac{1}{2}$  length of antenna and arising at  $\frac{2}{5}$ – $\frac{1}{2}$  from base; terminal and subterminal setae arising fairly close



FIG. 5—♂ genitalia of *Aedes theobaldi* Taylor, x 160.

together, one subterminal long, others shorter. Clypeal spines long, straight, slender, pointed. Setae B and C equal in length to antenna, A about  $\frac{3}{4}$  its length, all finely frayed. A 2-4 branched, arising a short distance behind base of antenna; B single, arising slightly behind A and  $\frac{2}{3}$  distance between it and mid line; C bifid, arising a short distance behind and slightly medial to B; d minute, simple, 6-10 branched, arising medial to and slightly behind B; e 1-4 branched, f 4-7 branched, both simple. Mentum triangular with a medial tooth and 7-8 equal lateral teeth, occasionally an additional smaller tooth basally.

*Thorax*: Shoulder hairs without prominent base, the posterior being long, strong and shortly plumose, the medial simple,  $\frac{2}{3}$  length of posterior, and the anterior 1-3 branched, about  $\frac{1}{2}$  length of medial. Metapleural tuft with 6-9 branches, base with several short spines.

*Abdomen*: Two pairs of long plumose lateral setae on segment I, the upper 3-4 branched, the lower 2-3 branched; one pair on II-VI, 2-4 branched on II, bifid on III-VI.

8th Segment: Lateral comb 16-24 slender pointed spines in 2-3 rows, each with a coarse fringe basally and with an elongate narrow base, the total length

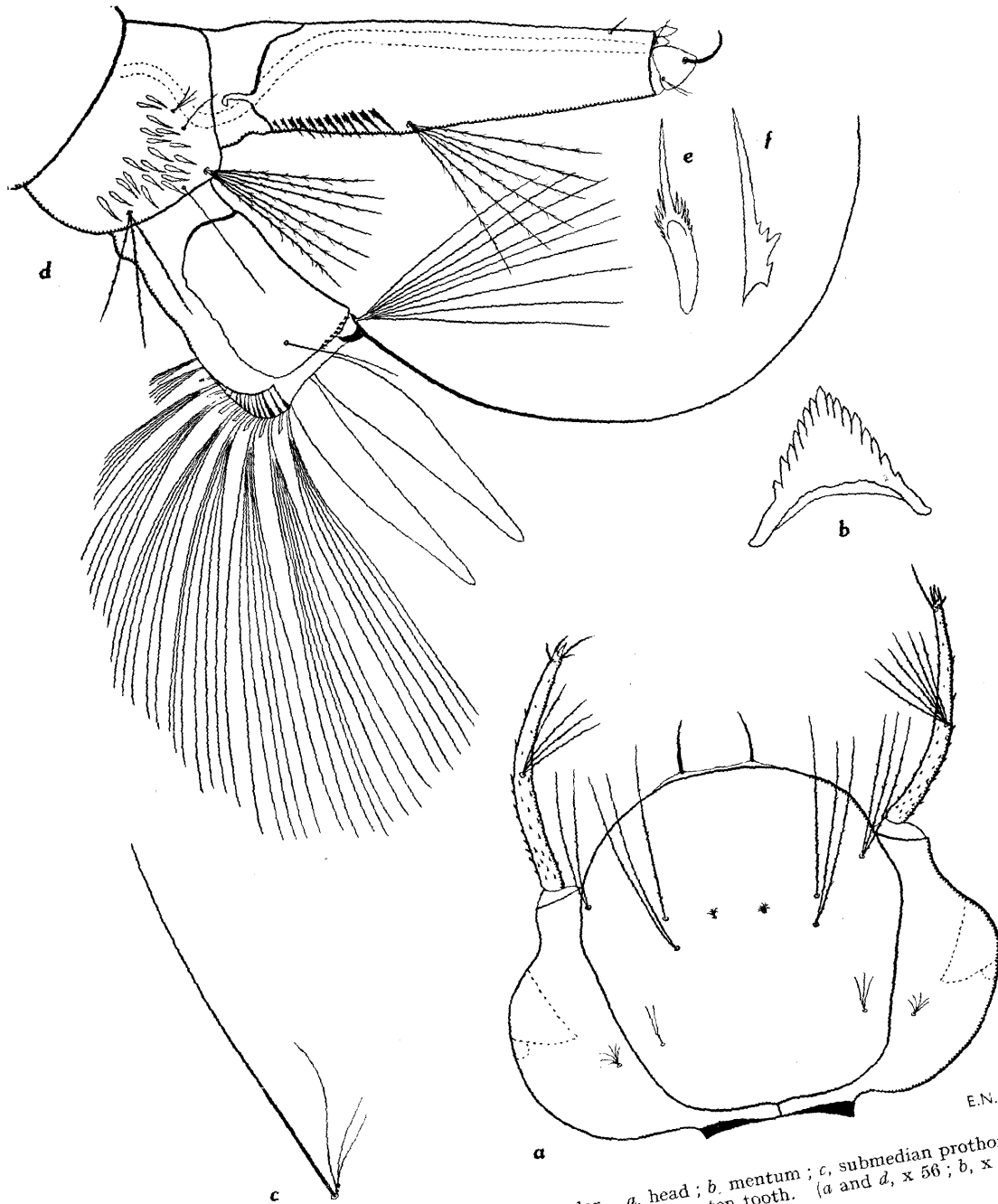


FIG. 6.—Larva of *Aedes theobaldi* Taylor. *a*, head; *b*, mentum; *c*, submedian prothoracic setae; *d*, terminal segments; *e*, lateral comb tooth; *f*, pecten tooth. (*a* and *d*, x 56; *b*, x 145; *c*, x 66; *e* and *f*, x 290).

E.N.M.

being 93–108  $\mu$ . First and second pentad setae fine, short and simple, first 2–6 branched, second single; third 6–11 branched, long, plumose; fourth moderately long, single, simple; fifth long, 2–5 branched, finely frayed.

Siphon: Index 3.3–3.9, slightly tapering beyond tuft; chitinisation not extending to base dorsally, tracheae very narrow. Pecten extending over approximately basal  $\frac{1}{4}$  of siphon, consisting of 9–15 spines each with 2–5 denticles at base, one of the 3 distal denticles being more prominent; the distal spine is the longest, being 93–107  $\mu$  in length, and they decrease in size proximally, the most proximal often being very small and scale-like. Subventral tuft 4–9 branched, long, plumose, arising at  $\frac{1}{3}$ – $\frac{2}{5}$  length of siphon. Acus present. The preapical seta on the ventral valve is very stout and forwardly curved.

Anal Segment: Saddle covering about  $\frac{2}{3}$  segment, with irregular ventral margin, and with a row of short pointed spicules dorsally at apex. Lateral seta single, simple, about  $\frac{2}{3}$  length of saddle. Dorsal subcaudal setae simple, upper 7–13 branched, about twice length of saddle, lower single,  $2\frac{1}{2}$  times length of upper. Ventral brush of 15–17 multiple tufts, each with 6–10 branches, arising from a grid except the basal 1–2 which are precratal. Gills equal, long, pointed, 2 x saddle.

Description based on two larval pelts, one correlated with adult, from Roma, and 11 whole larvae, 10 from Condamine and 1 from Yelarbon.

#### *Description of Pupa*: (Fig. 7)

General coloration brown.

*Cephalothorax*: Darker pigmentation behind insertion of trumpet and medially on metapostnotum, scarcely extending on to wing cover. Trumpet evenly pigmented, fairly narrow at base, widening gradually (about 3 times as long as greatest width), with oblique opening; ratio of meatus to whole 1:1.4; apical notch shallow.

*Abdomen*: Pigmentation slightly darker medially on segment I and bases of segments II and III. Float setae dendritic. Some of longer abdominal setae may be finely frayed. Lateral seta of segment VIII short, very sparsely plumose, 6–8 branched. Paddles oval (breadth index about 1.5), buttress and midrib moderately developed; paddle seta short, 4–5 branched.

Description based on one pupal pelt correlated with larva and adult, and one whole pupa correlated with larva, from Roma.

*Biology*: Larvae of *theobaldi* have been found in clear or slightly muddy casual rain water in grassy edged gutters of country roads and in hoof prints with trampled grass along the margins of these, being collected in June, about 8 days after heavy rain. They have also been taken in December from small rain filled pools in a gully, which were rapidly drying out.

The pupal period in June occupied about 4–5 days.

*Habits*: This species has been taken biting man both by day and night in forest, scrubs, or open country, and indoors in artificial light; it has also been collected biting a horse (Coolatai). In inland areas, after heavy rains, it may appear in large numbers, sometimes invading towns, as at St. George in March, 1944, when *theobaldi* and *theobaldi eidsvoldensis* caused inconvenience to householders in the late afternoon and at night.

*Distribution*: *Theobaldi* is essentially an inland species, but is occasionally taken in coastal areas in south east Queensland. It has been recorded from New South Wales, Victoria and South Australia and in Queensland was recorded by Bancroft (1908) from Brisbane, Deception Bay, Taylor's Range, Charleville and

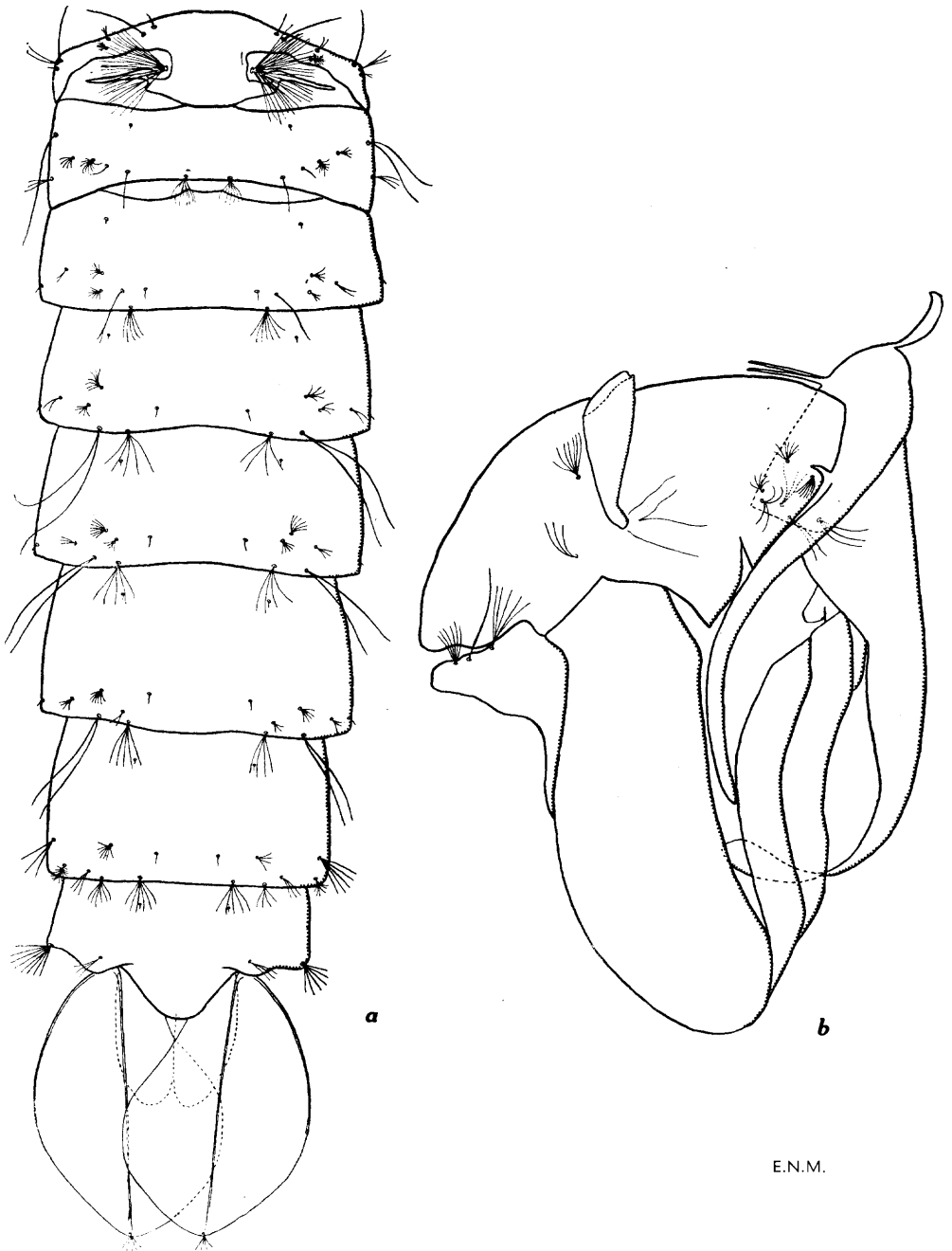


FIG. 7.—Pupal pelt of *Aedes theobaldi* Taylor, x 38. *a*, abdomen (dorsal view); *b*, cephalothorax.

E.N.M.

Normanby Station, and by Mackerras (1927) from Eidsvold. Additional localities are QUEENSLAND : Yelarbon, 3 ♀♀, larva (K. A. Walker and E. N. Marks, 30.xii.1943 and 20.i.1944) ; Goondiwindi, 1 ♀ (iii.1937) ; St. George (2.iii.1944) ; Roma, 1 ♂, larvae (J. L. Wassell, 10.v.1948) ; Condamine, larvae (J. L. Wassell, 11.v.1948). NEW SOUTH WALES : Coolatai, 1 ♀ (K. A. Walker, viii.1948).

### (3) AËDES (OCHLEROTATUS) THEOBALDI EIDSVOLDENSIS Mackerras.

*Aëdes (Ochlerotatus) theobaldi* (Taylor) form *eidsvoldensis* Mackerras, 1927, *Proc. Linn. Soc. N.S.W.*, 52 : 295.

*Type* : Holotype ♀, Eidsvold, 7.x.1926, I. M. Mackerras, in Macleay Museum, University of Sydney. When males and larvae are discovered this will very likely be found to represent a distinct species; the females show sufficient constant differences from typical *theobaldi* to warrant its being regarded as a subspecies.

*Distinctive Characters* : A medium sized species (wing length 3.0–3.5 mm.) distinguished by wing scaling and abdominal markings. Palpi dark scaled with white scales medially and at tip and some mottling besides. Basal  $\frac{2}{3}$  of proboscis pale scaled beneath, and may be extensively mottled above. Mesonotum clothed with narrow curved creamy to dull golden scales, sometimes with a small patch of bronzy black scales on the fossae. Femora very extensively mottled with pale scales anteriorly and pale scaled posteriorly except for dark tips to mid and hind femora ; tibiae very extensively mottled ; slight mottling on hind tarsal segment I ; tarsal segments I–III on fore legs and I–IV on mid and hind legs with basal white bands ; hind tarsal segment IV with band  $\frac{1}{4}$  its length.

Wings dark scaled with very extensive mottling of white scales on all veins, including squame and plume scales. The plume scales on  $R_2$  and  $R_3$  are narrow, but on  $R_s$  and the succeeding veins are fairly broad and square-ended (about 4 times as long as broad). Abdominal tergites II–IV have broad basal white or creamy bands produced posteriorly into large medial triangles ; on segment V the triangle extends  $\frac{2}{3}$  length of segment and on VI forms a complete vitta ; tergite VII is clothed with small scales, entirely pale, or mottled, or dark apically. Sternites are extensively mottled with pale scales.

*Biology* : Nothing is known of the biology of this species.

*Habits* : Mackerras recorded this species biting by day in forest country at Eidsvold ; at Taroom it was also taken biting by day. Broadwater specimens were caught indoors about dusk, in warm weather. At Longreach, specimens were taken in a dwelling at a time when swarms of mosquitoes in the town with habits similar to *A. vigilax* were causing the townspeople to complain. St. George had been reasonably free of mosquitoes when numbers of *A. theobaldi* and *theobaldi eidsvoldensis* invaded the town and caused inconvenience to householders in the late afternoon and at night.

*Distribution* : Known only from Queensland. The type locality is Eidsvold. Specimens have been examined from Broadwater (*via* Stanthorpe), 2 ♀♀ (I. Ross 6.xii.1943) ; St. George, 1 ♀ (2.iii.1944) ; Taroom, 1 ♀ (J. L. Wassell, 25.iv.1947) and Longreach (17.iii.1948).

### (4) AËDES (OCHLEROTATUS) sp. near THEOBALDI.

A single larva belonging to the *theobaldi* subgroup was found associated with larvae of *A. theobaldi*, *A. normanensis*, *A. vittiger*, *A. alternans* and *Culex* sp. in casual rain filled pools and hoof marks in a country road gutter near Condamine, Queensland (J. L. Wassell, ii.v.1948).

Distinguishing characters of this larva are: Antenna concolorous pale brown, tuft 4-5 branched, arising at  $\frac{1}{3}$  from base. Head setae A 4 branched, B and C bifid. Submedian prothoracic group without prominent base, the posterior seta 4 branched, long and finely plumose, twice the length of the single simple medial seta; the anterior seta bifid, simple,  $\frac{1}{2}$  length of medial. Upper lateral seta on abdominal segment I, 4 branched, lower single. Lateral comb of 20-24 pointed spines coarsely fringed basally and with an elongate base, the total length being approximately 67-92  $\mu$ ; fourth pentad seta single. Siphon with chitinisation not extending to base dorsally, index about 2.6; pecten of 9-11 spines, extending over basal  $\frac{3}{10}$  of siphon, the distal spine being about 78  $\mu$  in length; subventral tuft 5 branched, arising at  $\frac{1}{3}$  length of siphon. Saddle with a few small fringed spicules dorsally at apex; ventral brush of 16 multiple tufts, each with about 12 branches, 2 being precratal. Gills tapering, the upper  $1\frac{1}{2}$  times length of saddle, the lower slightly shorter.

### (5) *AÈDES* (*OCHLEROTATUS*) *NORMANENSIS* (Taylor).

*Culex normanensis* Taylor, 1915, *Proc. Linn. Soc. N.S.W.*, 40: 182.

*Aedes* (*Ochlerotatus*) *normanensis* Edwards, 1924, *Bull. ent. Res.*, 14: 375; Mackerras, 1927 (in part), *Proc. Linn. Soc. N.S.W.*, 52: 296.

*Types*: Specimens labelled "Type ♂ *Culex normanensis* Taylor, Normanton, Queensland, F. H. Taylor, July, 1914" and "Type ♀" with similar data, are in the collection of the School of Public Health and Tropical Medicine, Sydney, N.S.W. The type ♂ has its abdomen and one mid leg missing and hind tarsi damaged. An examination of two males bred from larvae from Normanton has now established the identity of this species and the male described and figured by Mackerras (1927) and larva figured by Lee (1944) have been found to represent a distinct species, *A. pseudonormanensis* n.sp.

*Distinctive Characters*: A small to medium sized species, distinguished by mesonotal and wing scaling. ♀—Palpi dark or with a few scattered white scales. Proboscis dark, or with basal  $\frac{1}{2}$  mottled, or with pale ventral streak. Mesonotum clothed with fine narrow curved bronzy black scales with scattered golden scales, the dark scales always predominating. Femora mottled, tibiae sparsely mottled; hind tarsal segments I-IV or V with basal white bands, covering not more than  $\frac{1}{4}$  IV and  $\frac{1}{5}$  V. Wing dark scaled with extensive mottling of white scales which includes both squame and plume scales on all veins, reduced towards apex of wing. The plume scales are narrow (about 9 times as long as broad) with rounded or pointed tips. Abdominal tergites II-VI with basal medial patches or bands, narrow or wide, with straight or pointed posterior margin, or rarely only a few pale scales. ♂—Wing with only a very few scattered white scales, usually on Sc. Genitalia: Coxite with elongate apical lobe bearing very numerous setae; prominent basal lobe with row of stout setae apically, its distal edge produced into a large thumb-like process bearing 3-4 stout dark setae; appendage of harpago moderately stout, angled at mid length but without retrorse projection.

Larva: Antenna concolorous. Head seta B single, C 2-3 branched, d very small. Setae of submedian prothoracic group all single, arising from a chitinised boss, the medial seta shorter than the anterior. Lateral comb of 13-20 pointed spines coarsely fringed at base; fourth pentad seta 2-3 branched. Siphon with chitinisation not extending to base dorsally, index 3.0. Pecten of 5-13 spines extending  $\frac{1}{4}$ - $\frac{1}{3}$  length of siphon; small pointed spicules at apex of saddle.

*Description of Adult ♀:*

Wing length 2.6-3.4 mm.

*Head:* Integument dark brown, clothed with narrow curved silvery white scales between which and the eye margin there is usually a band of narrow curved bronzy black scales which may be discontinuous medially. In addition, along the eye margin there may be a border of small narrow curved silvery scales. Upright forked scales numerous, dark brown. Laterally the head is clothed with flat white scales, the upper portion of which has a patch or mottling of similar dark scales. There are 1-2 pairs of strong dark vertical setae with, on each side, a row of about 6 similar medially directed ocular setae, and about 6 finer ocular setae laterally. Torus brown, clothed with small flat dark brown or mixed dark and white scales, the white scales tending to be dorsal in position. There are usually dark, or dark and white scales also on the 1st flagellar segment of antenna; flagellum brown with silvery clothing hairs and sparse brown verticillate hairs. Clypeus dark brown. Palpi  $\frac{1}{6}$ - $\frac{1}{5}$  length of proboscis, entirely dark scaled or with a few scattered white scales. Proboscis about  $1\frac{1}{4}$  times length of fore femur, entirely dark scaled or the basal half with a slight mottling of white scales or, rarely, a pale ventral streak; labella dark brown.

*Thorax:* Mesonotal integument brown to black, clothed with fine, narrow curved, bronzy black scales with scattered similar pale golden or silvery scales and with narrow curved, silvery white scales on either side and in front of prescutellar bare area; there is no suggestion of definite arrangement or pattern and the dark scales always predominate. Mesonotal bristles strong, dark; a double row of about 20-26 acrostichal, about 10-14 dorsocentral and about 12-17 prescutellar bristles; numerous dark bristles also on the fossae, laterally and above the wing roots. Scutellum brown, clothed with narrow curved silvery scales, the mid lobe sometimes with some dark scales also; border bristles dark, 6-10 long bristles to each lobe, in addition to shorter bristles. Metapostnotum brown. Pleura brown, clothed anteriorly mainly with narrow curved to spindle-shaped scales and posteriorly mainly with spindle-shaped to broad flat scales, the intermediate forms being difficult to define. Anterior pronotum with narrow curved silvery scales, sometimes with narrow curved or broader dark scales above. Posterior pronotum with mixed narrow curved dark and silvery scales, sometimes the lower scales being broader and spindle-shaped. Patches of narrow curved or spindle-shaped scales on propleuron, sub- and postspiracular areas and paratergite; patches of broad silvery scales on upper sternopleuron (which sometimes has a few broad dark scales and narrower silvery scales also), lower posterior margin of sternopleuron, prealar area and upper  $\frac{1}{2}$  of mesepimeron. Pleural bristles dark or pale, about 15-20 propleural, 5-8 posterior pronotal, 3-9 postspiracular, 2-6 upper sternopleural, a row of 5-8 long and several shorter bristles along posterior margin of sternopleuron, about 12-15 prealar, 10-14 upper and no lower mesepimeral bristles.

*Legs:* Dark scaled with mottled femora and tibiae and banded tarsi. Fore and mid coxae with dark scales below, white above; hind coxae bare or with a few white scales. Trochanters with mixed dark and pale scales. Fore leg: Femur mottled with white scales and with a white kneespot, sometimes with a complete basal ring of white scales and a white streak on the basal  $\frac{2}{3}$ - $\frac{3}{4}$  posteriorly; tibia sparsely mottled with sometimes a white patch dorsally at base or a white streak ventrally; tarsal segments dark, I rarely with a white ventral streak, I-III with narrow white basal bands  $\frac{1}{7}$ - $\frac{1}{6}$  I,  $\frac{1}{5}$ - $\frac{1}{3}$  II,  $\frac{1}{4}$ - $\frac{1}{3}$  III, sometimes a few white scales at base of IV and V. Mid leg: Femur mottled anteriorly, pale scaled posteriorly on basal  $\frac{2}{3}$  or almost to apex, with white kneespot. Tibia as on fore leg. Tarsal segments dark, I sometimes with a white streak beneath and I-III with narrow white basal bands  $\frac{1}{7}$ - $\frac{1}{6}$  I,  $\frac{1}{5}$ - $\frac{1}{4}$  II,  $\frac{1}{4}$ - $\frac{1}{3}$  III; usually a basal white patch on IV, up

to  $\frac{1}{3}$  its length, sometimes also on V. Hind leg : Femur similar to mid leg ; tibia mottled, with basal white patch dorsally ; tarsal segments dark, rarely a few scattered pale scales on I ; I-IV with white basal bands  $\frac{1}{2}-\frac{1}{3}$  I,  $\frac{1}{6}-\frac{1}{4}$  II, III and IV, sometimes a basal white patch on V up to  $\frac{1}{5}$  its length. Claws of fore and mid legs equal, unidentate ; hind equal, simple.

*Wings* : Dark scaled, extensively mottled with white scales on all veins, though the mottling is much reduced on the distal third of the wing. The mottling includes both squame and plume scales, the latter being long and narrow (about 9 times as long as broad) ; there may be a white patch basally on C. Cell  $R_2$   $1\frac{1}{2}-2\frac{2}{3}$  times the length of its stem ; cell  $M_1$  1-2 times the length of its stem ; their bases level, or more often that of cell  $M_1$  slightly proximal ;  $r-m$   $1-1\frac{1}{2}$  times its own length distal to base of  $M_{3+4}$ . Halteres pale, with white scaled knob, occasionally with a few dark scales also.

*Abdomen* : Integument dark brown. Tergite I with mixed dark and pale scales medially and white lateral patches. Tergites II-VII dark scaled with basal white bands or medial patches, usually discontinuous with large basal lateral white patches. The bands may be narrow or fairly wide, straight or somewhat produced medially, and on VI and VII the medial patches sometimes extend to the apex of the segment or the apical portion may be mottled with white scales. Rarely there are only two or three pale scales at the base of III-V, and the medial basal patches on II, VI and VII are greatly reduced. Sternites usually dark scaled, with mottling of white scales mainly laterally towards base, or may be more extensively mottled ; VII often entirely dark scaled. Segment VIII retracted, cerci long dark, exerted. Tergites with numerous scattered fine pale setae laterally and along the lateral and apical borders ; similar setae scattered over sternites.

Description based on 51 specimens from the following localities : Normanton (11, including a paratype), Van Rook (6), Croydon (6), Karumba (1), Inverleigh (1), Brock's Creek (5), Camp Mountain (16), Rocklea (4) ; also notes on a specimen in the Queensland Museum collection and the type female and one other in the School of Public Health and Tropical Medicine, Sydney, all being from Normanton.

#### *Description of Adult ♂ :*

The ♂ differs from the ♀ as follows :—Wing length 2.5-3.5 mm. The patches of narrow curved and flat dark scales on the head are reduced or absent, and there may be some pale upright forked scales on the vertex ; vertical and ocular setae may be pale. Torus brown, bare ; flagellar segments light brown with dense, dark brown, verticillate hairs. Palpi about  $1\frac{1}{4}$  times length of proboscis, dark scaled, with basal white patches on segments II-V, up to  $\frac{1}{4}$  length of III-V ; segments II and III may also be sparsely mottled with pale scales ; rarely the basal patches appear to be absent from II or V ; long dark hairs at tip of III and on IV and V. Proboscis  $1\frac{1}{4}-1\frac{1}{2}$  times length of fore femur, dark scaled with an indefinite pale band or a white ventral patch medially, sometimes with some mottling of pale scales on basal half. Mesonotal scaling similar to ♀ but pale golden scales usually more numerous, though dark predominate ; scutellar bristles may be pale, 6-9 long bristles to mid lobe and 4-6 to lateral lobes. The posterior pronotum may bear only narrow curved pale golden and creamy scales or only spindle-shaped scales ; there may be some broad scales on subspiracular area ; paratergite may be bare ; about 30 propleural and 4-6 posterior pronotal bristles. Legs : Coxae may have pale scales only ; femora and tibiae more sparsely mottled than in female ; fore and mid tarsal segments I-II or I-III with narrow white basal bands, rarely a few white scales at base of mid tarsal segment IV ; hind tarsal segments I-IV with basal white bands  $\frac{1}{3}-\frac{1}{6}$  I,  $\frac{1}{4}-\frac{1}{5}$  II,  $\frac{1}{6}-\frac{1}{3}$  III and IV ; IV sometimes with a basal patch only and V sometimes with a basal white patch. Claws of fore and mid

legs unequal, the anterior long with a strong tooth, posterior simple; hind claws equal, simple. Wings: Scaling sparse and dark, usually with a very small number of scattered white scales which may be on any vein, but are most frequently on *Sc*; cell  $R_2$   $1-1\frac{1}{2}$  times the length of its stem, cell  $M_1$   $\frac{2}{3}-1$  times the length of its stem, its base proximal to that of cell  $R_2$ ; *r-m*  $1-2$  times its own length distal to base of  $M_{3+4}$ . Knob of halteres may be more extensively dark scaled than in female. Abdomen: Tergite I with a patch of dark or white scales medially. Tergites II-VII dark scaled without white lateral patches, but with white basal bands or medial patches which may be straight or slightly widened medially. Sternites dark scaled, usually with some white scales laterally towards base. Segment VIII is dark scaled, the tergite with scattered white scales and occasionally a few scattered white scales also on the sternite.

Described from 19 specimens, 2 from Normanton, 15 from Camp Mountain, and 1 each from Geebung and Trebonne, also notes on the type ♂.



FIG. 8—♂ genitalia of *Aedes normanensis* Taylor, x 160.

♂ Genitalia: (Fig. 8)

Coxite dark scaled laterally and sternally, sometimes with white scales laterally at base, about  $3\frac{1}{2}-4$  times as long as mid width, with a membranous area along its inner aspect, tergal to which are a prominent basal lobe and an elongate apical

lobe. The latter bears very numerous long, straight, medially directed setae and some shorter fine setae along its inner edge. The basal lobe is clothed with short fine setae except along its distal edge which is produced into a thumb-like process bearing 3-4 strong dark setae curving proximally; the apical border of the lobe is straight or concave and bears a row of 6-9 slightly finer setae, arising from prominent tubercles and curving in a distal or sternal direction; 1-2 of these may arise from the basal portion of the thumb-like process. Tergally the coxite bears scattered long setae, with a few short setae near its base; laterally and sternally it bears numerous long setae with, sternally, some very long ones towards apex and shorter finer setae along inner margin and at base. Style about  $\frac{3}{5}$  length of coxite, slender, narrow at base and curved and tapering on apical  $\frac{1}{4}$ ; terminal appendage  $\frac{1}{3}$  length of style, slender, tapering, with grooved tip. Harpago short, pilose, with, on its inner side, 1-4 short fine setae and a short blunt process at apex from which one of the setae may arise; appendage fairly stout, a little shorter than or equal in length to harpago, slightly broadened and angled at midlength but without retrorse projection, and tapering to a fine pointed tip. Paraprocts with 1-2 teeth. Phallosome simple, oval, broader basally. Lobes of IXth tergite with 3-6 short stout setae; IXth sternite with 2-5 setae.

*Description of Larva:* (Fig. 9)

Length 5.5-6.5 mm. A light grey larva with brown head, siphon and saddle.

*Head:* About  $\frac{2}{3}$  as long as broad. Antenna uniform brown, about  $\frac{3}{4}$  length of head, 10 times as long as broad at base, slightly curved and tapering, clothed with spicules densest on basal  $\frac{1}{2}$ ; tuft 3-9 branched, finely frayed, almost  $\frac{1}{2}$  length of antenna and arising at about  $\frac{1}{2}$  from base; terminal and subterminal setae arising fairly close together, one subterminal long, others shorter. Clypeal spines straight, slender, pointed. Setae A, B and C about  $\frac{3}{4}$  length of antenna, finely frayed; A arising a short distance behind base of antenna, 1-4 branched but usually bifid; B single, arising slightly behind A and  $\frac{1}{2}$  way between it and midline; C 2-3 branched, arising a short distance behind and slightly medial to B; d minute, simple, 4-9 branched, arising level with and medial to B; e 2-4 branched, f 3-6 branched, both simple. Mentum triangular, with a medial tooth and 8-10 equal lateral teeth.

*Thorax:* Submedian prothoracic group consisting of 3 single hairs arising from a chitinised boss; the posterior is long, strong and finely plumose; the anterior finer, simple,  $\frac{2}{3}$  length of posterior; the medial is very fine, simple,  $\frac{2}{3}$  length of anterior. Branched seta of metapleural tuft with 6-9 branches, base with a prominent slender pointed spine and several shorter spines.

*Abdomen:* Two pairs of shortly plumose, long lateral setae on segment I, the upper 3-8 branched, the lower 3-6 branched; one pair on II-VI, 2-5 branched on II, 1-3 branched on III-V and 1-2 branched on VI, but usually bifid on all segments.

8th Segment: Lateral comb 13-20 slender pointed spines in 2-3 rows, each with a coarse fringe basally and with an elongate narrow base, the total length being approximately 85-155  $\mu$ . First, second and fourth pentad setae fine, short and simple; first 1-3 branched, usually bifid; second usually single, may be bifid; third 5-9 branched, long, plumose; fourth 2-3 branched, usually bifid; fifth 2-5 branched, stout and finely frayed.

Siphon: Index approximately 3.0, slightly tapering beyond tuft; chitinisation not extending to base dorsally; tracheae very narrow. Pecten extending over basal  $\frac{1}{4}$ - $\frac{1}{3}$  of siphon, consisting of 5-13 spines each with 2-5 rather variable lateral denticles at base, the apical or preapical denticle being prominent; the distal spine

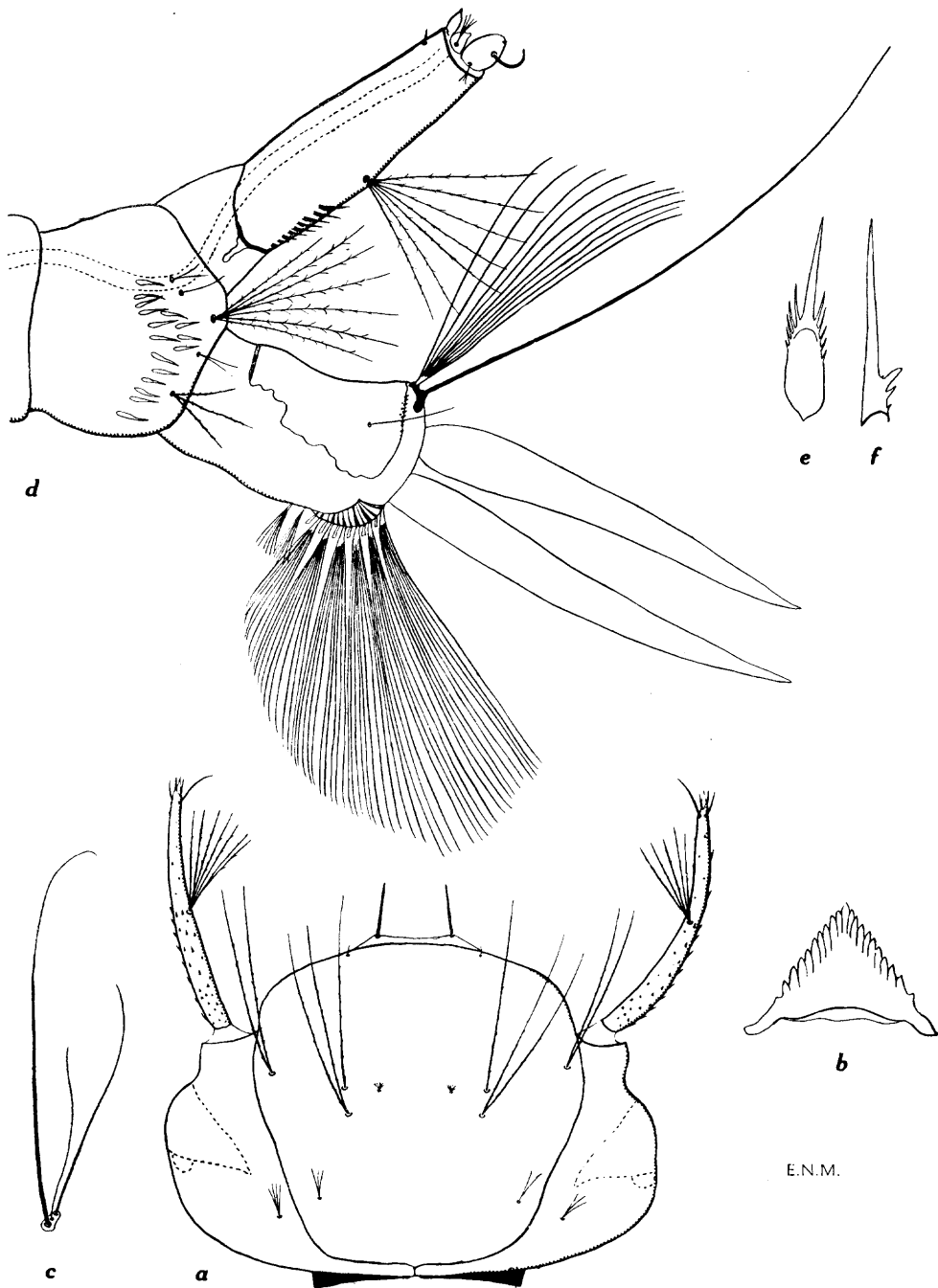


FIG. 9.—Larva of *Aedes normanensis* Taylor. *a*, head; *b*, mentum; *c*, submedian prothoracic setae; *d*, terminal segments; *e*, lateral comb tooth; *f*, pecten tooth (*a* and *d*, x 56; *b*, x 145; *c*, x 66; *e* and *f*, x 290).

E.N.M.

is the longest, being about 85–117  $\mu$  in length, and they decrease in size proximally, the most proximal often being very small and scale-like. Subventral tuft 5–13 branched, long, plumose, arising at slightly more than  $\frac{2}{3}$  length of siphon. Acus present. The preapical seta on the ventral valve is very stout and forwardly curved.

Anal Segment: Saddle covering slightly more than  $\frac{1}{2}$  segment, with very irregular ventral margin and with a row of short pointed spicules dorsally at apex. Lateral seta single, simple, about  $\frac{2}{3}$  length of saddle. Dorsal subcaudal setae simple, upper 9–17 branched, about twice length of saddle, lower single, about twice length of upper. Ventral brush of 12–15 (usually 14) multiple tufts each with 9–16 branches, arising from a grid except the proximal one or two which are precratal. Gills long, tapering, pointed,  $2\frac{1}{2}$ –3 times length of saddle, the lower pair slightly longer than the upper.

Description based on 36 complete specimens comprising 6 whole larvae and 24 pelts correlated with adults from Camp Mountain, 2 pelts (also portions of several pelts and whole larvae) from Normanton, 2 whole larvae from Enoggera, and 2 pelts (also portions of several others) from Rocklea.

*Description of Pupa:* (Fig. 10)

General coloration brown.

*Cephalothorax:* Darker pigmentation extending from short distance behind anterior margin, above and behind trumpets, medially on to metapostnotum, and also slightly on to upper and posterior margins of wing covers; the fore leg sheath is also darkly pigmented. Trumpet evenly pigmented, widening gradually from base, about 3 times as long as greatest width with very oblique opening; ratio of meatus to whole 1:1.7–1.9; apical notch shallow.

*Abdomen:* Pigmentation slightly darker medially on segment I and bases of segments II–V. Float setae dendritic. Some of longer abdominal setae may be finely frayed. Lateral seta of segment VIII short, plumose, 4–8 branched. Paddles pear shaped (breadth index 1.2–1.3); buttress and midrib moderately developed; paddle seta short, 3–7 branched.

Description based on one complete pupal pelt and portions of three others from Normanton and seven pelts from Camp Mountain correlated with adults, though not individually, also one pelt correlated with adult from Trebonne.

*Biology:* The breeding places of *normanensis* are casual pools or swampy areas resulting from heavy rain, fully or partially exposed to the sun and varying in extent from about  $\frac{1}{2}$  sq. ft. to 2 acres. The water, always fresh, may be clear, slightly discoloured or muddy, and sometimes slightly polluted by animal manures. The pools may have sides and bottom of earth, mud or gravel, without vegetation or have marginal grasses only, or grassy bottom, sometimes with weeds and sedges. The edges of the pools may be shallow, sloping or steep and the depth of water varies from 1 inch to 2 feet. The pools may occur in natural depressions, dry water courses, or man-made excavations, including country road gutters and earth formed street water channels in semi-rural areas; larvae may also be found in hoof prints round the margins of such pools.

Larvae of *normanensis* are sometimes found alone. Species which have been found most frequently associated with them in the Greater Brisbane area and at Camp Mountain are *Anopheles* (*Myzomyia*) *annulipes* Walker, *A. alternans*, *A. vigilax*, *A. rubrithorax*, *A. vittiger* and *Culex* (*Culex*) *annulirostris* Skuse; less commonly found are *Anopheles* (*Anopheles*) *bancrofti* Giles, *A. alboannulatus*, *Aedes* (*Banksinella*) *lineatopennis* (Ludlow), *Culex* (*Lutzia*) *halifaxi* Theo. and *Culex* (*Culex*) sp. In the Roma-Condamine area, species associated were *A. alternans*, *A. theobaldi*,

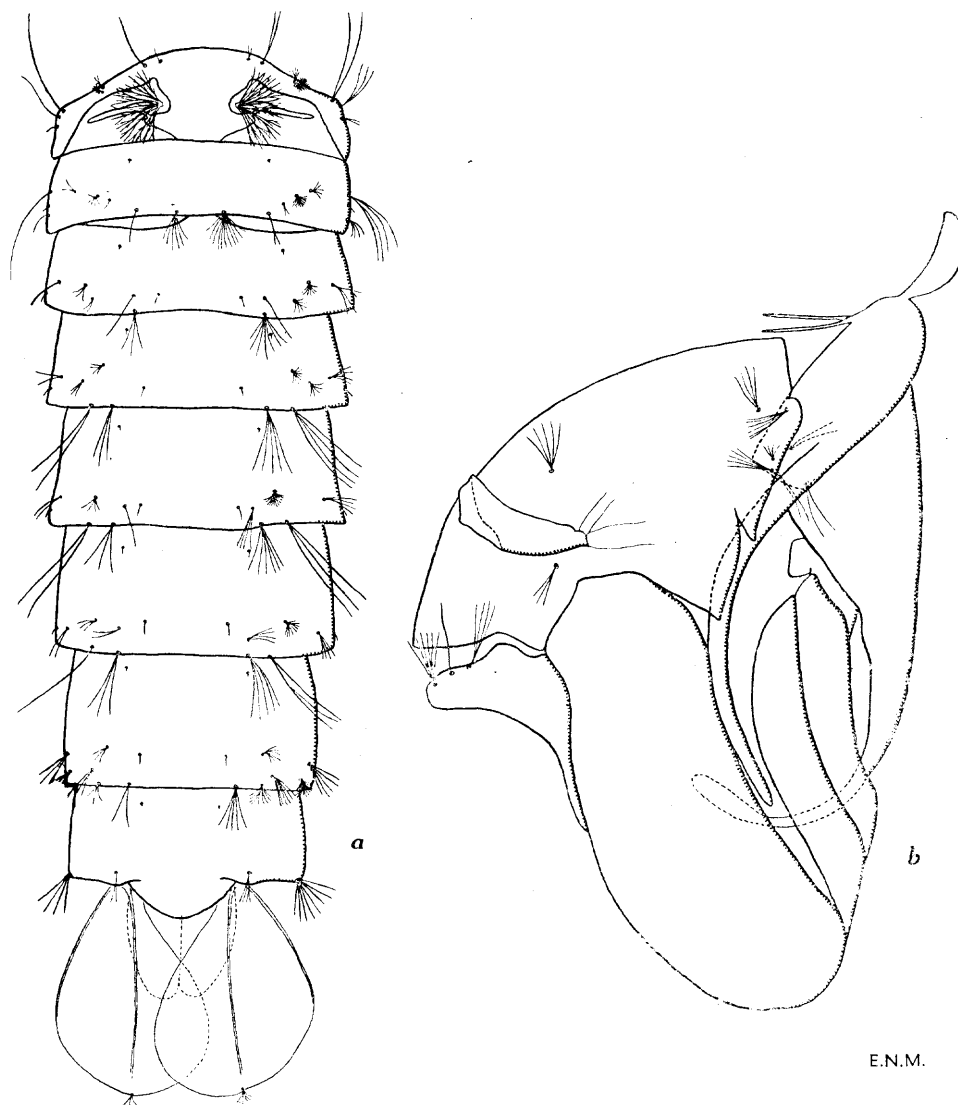


FIG. 10—Pupal pelt of *Aedes normanensis* Taylor, x 38. *a*, abdomen (dorsal view); *b*, cephalothorax.

*A. vittiger*, *Aedes* sp. near *theobaldi* and *Culex* (*Culex*) sp. At Trebonne the associated species were *A. annulipes*, *C. annulirostris* and *Culex* (*Culex*) *whitmorei* (Giles).

At Camp Mountain regular observations were made of a series of grassy depressions in a shallow run-off from a grassy flat. The dry depressions were filled by 3½ in. rain on the night of 11th February, 1945; pupae were collected from these pools on 18th February and adults, including *normanensis*, had all emerged by 8 p.m. on 19th February, i.e., within 8 days of the pools being filled.

These depressions were again filled by rain in June, July, September and October, 1945, but although other species were collected from them, *normanensis* was not taken again until 16th December. Pupal period of specimens collected then was 2-2½ days. Between 19th and 26th January, 1946, about 4½ in. of rain filled the depressions again. Larvae of *normanensis* were collected about 6 p.m. on 26th, at which time no pupae were observed in the pool. Eight of these larvae had pupated by 9 p.m. the same evening and the last of the batch pupated during the night of 30th January, emerging before 9 a.m. on 1st February. The breeding places were dry by 3rd February. Pupal period of these specimens was somewhere between 24 and 40 hours. *Normanensis* was collected also from these depressions during February and March, 1946.

In larval collections made by Brisbane City Council workers in the course of an Anopheline Survey of the Greater Brisbane Area, from June, 1946, to June, 1948, this species was found on 18 occasions but there were no records of it from early May until October. This may perhaps be attributed to these being months of low average rainfall, but taken in conjunction with Camp Mountain observations, it does suggest that *normanensis* does not breed during the winter in south-eastern Queensland. However, this species has been found breeding during June in south western (Roma, Condamine) and northern (Trebonne) parts of the State.

*Habits* : Caged females which had emerged on 28th January, 1946, bit man readily the following day. The bite was not painful either while it was in process or afterwards. At Taroom specimens were taken biting about 3.30 p.m. At Croydon adults were caught on house verandahs about 4.30 p.m.

*Distribution* : Specimens have been examined from the following localities—QUEENSLAND : Normanton (the type locality), 11 ♀♀, 2 ♂♂, larvae (1 ♀ paratype, remainder G. Wiles 7.ii.1944); Van Rook, 6 ♀♀ (i.1948); Croydon, 6 ♀♀ (J. Rice, 22.ii.1944); Karumba, 1 ♀ (F/Sgt. Childe, 7.viii.1944); Inverleigh, 1 ♀ (F/Sgt. Childe, viii.1944); Trebonne *via* Ingham, 1 ♂ (E. N. Marks and J. Fisher, 28.v.1946); Taroom, 2 ♀♀ (J. L. Wassell, 25.iv.1947); Roma, larvae (J. L. Wassell, 10.v.1948); Condamine, larvae (J. L. Wassell, 11.v.1948); Camp Mountain, 16 ♀♀, 15 ♂♂, larvae (E. N. Marks, 16.xii.1945, 26-28.i.1946); Brisbane-Rocklea, 4 ♀♀, larvae (P. J. Sparks, 2.x.1946), Geebung, 1 ♂ (J. H. Carney, 24.x.1946), Enoggera, larvae (J. L. Wassell, 25.iii.1944). NORTHERN TERRITORY : Burnside Station, Brock's Creek, 5 ♀♀ (T. G. Campbell, 20-24.iv.1929); Katherine, 1 ♀ (H. J. T. Bake, 1943). The paratype and Brock's Creek specimens are from C.S.I.R. Museum;

(6) **AÈDES (OCHLEROTATUS) PSEUDONORMANENSIS** n. sp.

*Aedes (Ochlerotatus) normanensis* Mackerras, 1927, *Proc. Linn. Soc. N.S.W.*, 52 : 288, 293 (figure of ♂ genitalia); Lee, 1944, *Atlas of Mosquito Larvae of the Australasian Region*, Australian Military Forces. (Restricted) : 40 (figure of larva).

*Types* : Holotype ♀, allotype ♂, Eidsvold, Queensland, xii.1922, I. M. Mackerras.

Paratypes : 4 ♀♀, 2 ♂♂, same data as holotype; the allotype and one paratype ♂ are labelled in addition "Larvae E.9." Holotype ♀, allotype ♂, 1 ♀ and 1 ♂ paratype in Macleay Museum, University of Sydney; 3 ♀♀ and 1 ♂ paratype in collection of School of Public Health and Tropical Medicine, Sydney, N.S.W.

*Distinctive Characters* : A small to medium sized species, distinguished by mesonotal and wing scaling. ♀—Palpi dark or with a few scattered white scales. Proboscis creamy on basal ⅔ beneath or with only a few pale scales or indefinite pale streak beneath. Mesonotum clothed with narrow curved golden scales, usually with a patch of bronzy black scales on the fossa and another between the scutal angle and the wing root. Mottling of femora and tibiae moderate to sparse. Hind tarsal segments I-IV or V with basal white bands covering not more than ¼ IV and ⅓ V. Wing dark scaled with mottling of white scales which includes both

squame and plume scales and may be extensive on all veins, or sparse and restricted to the anterior veins. The plume scales are narrow (about 9 times as long as broad) with rounded or pointed tips. Abdominal tergites dark scaled; II-VI with small basal medial white patches, or wide basal bands, straight or rounded posteriorly. ♂—Wing sparsely scaled, with only 1 or 2 white squame scales on C or Sc. Genitalia: Coxite with elongate apical lobe bearing about 8 scattered setae; prominent basal lobe with row of stout setae apically, its distal edge produced into a small thumb-like process bearing a single slender seta. Appendage of harpago slender, angled at  $\frac{2}{3}$  its length, the angle produced into a short retrorse projection.

Larva: Antenna with basal  $\frac{1}{2}$  pale, apical  $\frac{1}{2}$  brown. Head setae B single, C single or bifid, d very small. Submedian prothoracic group without prominent base, the anterior seta 1-3 branched, shorter than the single medial; the posterior single. Lateral comb of 16-20 pointed spines finely fringed at base; fourth pentad seta single. Siphon with chitination not extending to base dorsally, index 3.0-3.5. Pecten of 9-15 spines, extending  $\frac{1}{3}$  length of siphon; small fringed spicules at apex of saddle.

*Description of Adult:*

*Holotype* ♀:

Wing length 3.1 mm.

*Head:* Integument brown, clothed with narrow curved silvery white scales, with a line of small narrow curved pale golden scales along the eye margin, behind which is a line of small narrow curved bronzy black scales, discontinuous medially; upright forked scales dark brown. Laterally the head is clothed with flat white scales with a patch of dark scales near their upper margin. There are 2 pairs of strong dark vertical setae with, on each side, a row of 6 similar medially directed ocular setae and 5 finer ocular setae laterally. Torus yellowish brown laterally, darker and with numerous small flat white scales medially; basal half of first flagellar segment yellowish brown and bearing similar white scales, remainder of flagellum dark with silvery clothing hairs and sparse black verticillate hairs. Clypeus dark brown. Palpi about  $\frac{1}{6}$  length of proboscis, black scaled with a few scattered white scales. Proboscis about  $1\frac{1}{4}$  times length of fore femur, dark scaled above, creamy scaled on basal  $\frac{2}{3}$  beneath, except for dark ring at base; labella dark.

*Thorax:* Integument dark brown. Mesonotum clothed with narrow curved golden scales with a patch of bronzy black scales on the fossa and a similar patch half way between the scutal angle and the wing root, running from the line of dorsocentral bristles almost to the lateral margin; there is also a sprinkling of dark scales along the lines of acrostichal and dorsocentral bristles; narrow curved creamy scales on either side and in front of prescutellar bare area. Mesonotal bristles strong, dark; a double row of about 24 acrostichal, about 15 dorsocentral and about 12 prescutellar bristles; numerous dark bristles also on the fossae, laterally, and above the wing roots. Scutellum light brown, clothed with fine narrow curved golden and creamy scales; border bristles strong, brown, 5-6 long bristles to lateral lobes and 7 to medial lobe in addition to shorter bristles. Metapostnotum reddish brown.

*Pleura:* Anterior pronotum with spindle-shaped white scales; posterior pronotum with narrow curved golden scales anteriorly, spindle-shaped dark scales medially and creamy posteriorly; propleuron with narrow curved white scales; patches of flat white scales on sub- and postspiracular areas, upper sternopleuron, lower posterior margin of sternopleuron, paratergite, prealar area and upper half of mesepimeron. Pleural bristles dark or pale; about 15 propleural, 5 posterior pronotal, 9-10 postspiracular, 4 upper sternopleural, a row of 6 long and several shorter bristles along posterior margin of sternopleuron, about 18 prealar, about 14 upper and no lower mesepimeral bristles.

*Legs* : Dark scaled with mottled femora and tibiae and banded tarsi. Fore coxa with dark scales below, white above, mid and hind coxae with white scales only. Trochanters pale scaled. Foreleg : Femur with an almost complete basal white ring, moderately mottled anteriorly, with a pale streak posteriorly not reaching to apex, and with a white knee spot extending on to base of tibia ; tibia slightly mottled and with some pale scales at apex ; tarsal segments I-III with basal white bands  $\frac{1}{3}$  I,  $\frac{1}{4}$  II and III. Mid leg : Femur and tibia as on fore leg but femur with basal  $\frac{2}{3}$  entirely pale scaled posteriorly ; tarsal segments I-IV with basal white bands  $\frac{1}{10}$  I,  $\frac{1}{5}$  II,  $\frac{1}{4}$  III and IV. Hind leg : Femur and tibia as on mid leg ; tarsal segments I-V with basal white bands  $\frac{1}{10}$  I,  $\frac{1}{5}$  II,  $\frac{1}{4}$  III-V. Claws of fore and mid legs equal, unidentate ; hind equal, simple.

*Wings* : Dark scaled, fairly extensively mottled with white scales on all veins, including squame and plume scales, the latter being long and narrow (about 9 times as long as broad) ; the mottling is reduced towards the wing tip. Cell  $R_2$  nearly twice the length of its stem ; cell  $M_1$  scarcely longer than its stem, its base slightly proximal to that of cell  $R_2$  ;  $r-m$   $1\frac{1}{2}$  times its own length distal to base of  $M_{3+4}$ . Halteres pale with white scaled knob.

*Abdomen* : Integument brown. Tergites I and VII dark scaled medially ; II-VI dark scaled with small medial basal white patches and I-VI with large lateral basal white patches, smaller on VII ; sternites dark scaled with large lateral basal white patches, VII with a few white scales laterally at base. Segment VIII retracted, cerci long, dark, exerted. Tergites with numerous fine pale setae laterally and along the apical border ; similar setae scattered over the sternites.

The following are the main variations from the holotype shown by a series of 7 ♀♀ comprising 4 paratypes and specimens from Clermont and Theodore :— Wing length 2.8-3.1 mm. Some of the upright forked scales on the vertex may be creamy ; there may be no dark narrow curved scales on the head and the lateral patch of dark flat scales may be reduced ; there may be a few dark scales among the white on the torus and no scales on the first flagellar segment ; palpi may be entirely dark scaled ; the proboscis may have only a few pale scales or an indefinite pale streak beneath. Mesonotal integument brown to black ; there may be no dark scales along the lines of acrostichal and dorsocentral bristles ; some specimens show a tendency to linear arrangement of the mesonotal scales but in others this is entirely absent ; 5-7 long bristles to lateral lobes of scutellum and 6-8 to medial lobe. There may be narrow curved white scales on the anterior pronotum ; the paratergite may be bare ; 5-9 posterior pronotal and 5-8 postspiracular bristles. Legs : Mid and hind tibiae may be pale behind almost to apex. Basal bands on fore tarsal segments cover  $\frac{1}{12}-\frac{1}{8}$  I,  $\frac{1}{6}-\frac{1}{3}$  II,  $\frac{1}{5}-\frac{1}{3}$  III, and on mid tarsal segments cover  $\frac{1}{12}-\frac{1}{8}$  I,  $\frac{1}{6}-\frac{1}{4}$  II,  $\frac{1}{4}-\frac{1}{3}$  III, with usually a few white scales or a band up to  $\frac{1}{3}$  length of IV and rarely a small white basal patch on V ; basal bands on hind tarsal segments cover  $\frac{1}{14}-\frac{1}{10}$  I,  $\frac{1}{6}-\frac{1}{5}$  II,  $\frac{1}{6}-\frac{1}{4}$  III and IV, with a few white scales or band up to  $\frac{1}{5}$  length of V, or rarely V is all dark. Wings : The mottling of white scales may be sparse, and restricted mainly to the anterior veins ; cell  $R_2$   $1\frac{2}{3}$ -2 times the length of its stem ;  $r-m$  1- $1\frac{1}{3}$  times its own length distal to base of  $M_{3+4}$ . Halteres sometimes with a few dark scales on under side of knob. Abdominal tergite I may have mixed dark and pale scales medially and III-VI may have wide basal white bands extending to the lateral margin ; VII may have a basal white band or be entirely dark scaled ; on the distal sternites the lateral basal white patches may meet medially.

A female from Inverleigh, which apparently belongs to this species, differs from the above series in having no dark scales on the fossae, only 2 or 3 dark scales in the position of the posterior mesonotal patch, abdominal tergites II-VI with rounded basal medial white patches and sternites with some slight mottling apically.

*Description of Adult ♂:*

A series of 4 ♂♂, comprising the allotype, 2 paratypes and one ♂ from Mareeba differ from the ♀♀ in the following characters:—Wing length: 2.7–2.9 mm. No narrow curved dark scales, and few or no flat dark scales on head; tori large, brown, bare; flagellar segments light brown, with dense dark brown verticillate hairs. Palpi  $1\frac{1}{5}$  length of proboscis, dark scaled with sometimes some white scales on segment I and with basal white bands on segments II–V,  $\frac{1}{5}$ – $\frac{1}{4}$  II,  $\frac{1}{4}$ – $\frac{1}{3}$  III and  $\frac{1}{3}$  IV and V; long dark hairs at tip of III and on IV and V. Proboscis with a narrow pale indefinite medial band. Mesonotum entirely golden scaled or with 1 or 2 dark scales in the position of the dark patches of the ♀; 4–5 long bristles to lateral lobes of scutellum and 5–7 to medial lobe; anterior pronotum may have narrow curved and broad white scales and there may be no dark scales on posterior pronotum; paratergite is bare; 3–7 postspiracular bristles. Mottling on femora and tibiae is slight; basal white band may be up to  $\frac{1}{3}$  length of hind tarsal segment V. Claws of fore and mid legs unequal, the anterior long with a strong tooth, posterior simple; hind claws equal, simple. Wings very sparsely scaled and with only 1 or 2 white squame scales on C or Sc; cell  $R_2$   $1\frac{1}{2}$ – $1\frac{1}{3}$  length of its stem, cell  $M_1$  about  $\frac{3}{4}$  length of its stem. Abdominal tergites II–VII with wide white basal bands; sternites dark scaled with white basal lateral patches, segment VIII dark scaled with some white scales laterally at base. Dense long setae laterally and apically on the tergites and scattered over the sternites.



E.N.M.

FIG. 11—♂ genitalia of *Aedes pseudonormanensis* n.sp., x 160.*♂ Genitalia:* (Fig. 11)

Coxite dark scaled laterally and sternally, about  $3\frac{1}{2}$  times as long as mid width, with a membranous area along its inner aspect, tergal to which are a prominent

basal lobe and a slightly developed elongate apical lobe. The latter bears about 8 scattered long medially directed setae. The basal lobe has its distal edge produced into a short thumb-like process bearing a single slender seta curving proximally; the apical and proximal edges of the lobe are rounded and bear a row of 9–12 flattened setae arising from prominent tubercles and curving mainly in a distal direction; tergal to these are about 4 rows of fine setae. Tergally the coxite bears scattered long setae with a few short setae near its base; laterally and sternally it bears numerous long setae with some very long flattened setae towards apex sternally and short fine setae at base. Style  $\frac{3}{4}$  length of coxite, slender, narrow at base and curved and tapering on apical  $\frac{1}{4}$ ; terminal appendage  $\frac{1}{4}$  length of style, slender, tapering, with grooved tip. Harpago short, pilose, with 1 or 2 fine setae on its inner side; appendage longer than harpago, slender, sharply angled at  $\frac{2}{3}$  its length, the apical portion tapering to a fine point and the angle produced into a short retrorse projection. Paraproct with a single tooth. Phallosome simple, oval. Lobes of IXth tergite with 3–4 setae; IXth sternite with 3–4 setae.

*Description of Larva: (Fig. 12)*

Length about 5.0–5.8 mm. A pale larva with light brown head, siphon and saddle.

*Head:*  $\frac{2}{3}$ – $\frac{3}{4}$  as long as broad. Antenna with basal half pale and apical half brown, about  $\frac{2}{3}$  length of head and 10 times as long as broad at base, slightly curved and tapering, clothed with spicules; tuft 4–8 branched, finely frayed, about  $\frac{1}{2}$  length of antenna and arising at about  $\frac{1}{2}$  from base; terminal and subterminal setae arising fairly close together, one subterminal long, others shorter. Clypeal spines long, straight, slender, pointed. Seta A about  $\frac{3}{4}$  length of antenna, B and C slightly longer than A, all single and finely frayed (in one specimen A bifurcates about mid length); A arising a short distance behind base of antenna; B arising slightly behind A and  $\frac{2}{3}$  distance between it and mid line; C arising a short distance behind and slightly medial to B; d minute, simple, 4–6 branched, arising medial to and slightly behind B; e 2–4 branched, f 3–7 branched, both simple. Mentum triangular with a medial tooth and 9–11 equal lateral teeth.

*Thorax:* Submedian prothoracic hairs without prominent base, the posterior being long, strong and finely plumose, the medial simple, about  $\frac{1}{2}$  length of posterior, and the anterior simple, 1–3 branched, length variable but not longer than medial. Branched seta of metapleural tuft with 6–9 branches, base with several short spines.

*Abdomen:* Two pairs of shortly plumose long lateral setae on segment I, the upper 3–4 branched, the lower 2–4 branched; one pair on II–VI, single or bifid on II, 3–4 branched on III and IV, 2–4 branched on V and 2–3 branched on VI.

8th Segment: Lateral comb 16–20 slender pointed spines in 2–3 rows, each with a long fine fringe basally and with an elongate base, the total length being approximately 50–75  $\mu$ . First and second pentad setae fine, short and simple; first 2–3 branched, second 1–2 branched; third 9–12 branched, long, plumose; fourth single, moderately long, simple; fifth 4–7 branched, long, finely frayed.

Siphon: Index about 3.0–3.5, slightly tapering beyond tuft; chitinisation not extending to base dorsally, tracheae very narrow. Pecten extending over approximately basal  $\frac{1}{3}$  of siphon, consisting of 9–15 spines each with 1–4 denticles at base, the apical or preapical denticle being prominent; the distal spine is the longest, being about 80–110  $\mu$  in length, and they decrease in size proximally, the most proximal often being very small and scale like. Subventral tuft 6–9 branched, long, plumose, arising at slightly less than  $\frac{1}{2}$  length of siphon. Acus present. The preapical seta on the ventral valve is very stout and forwardly curved.

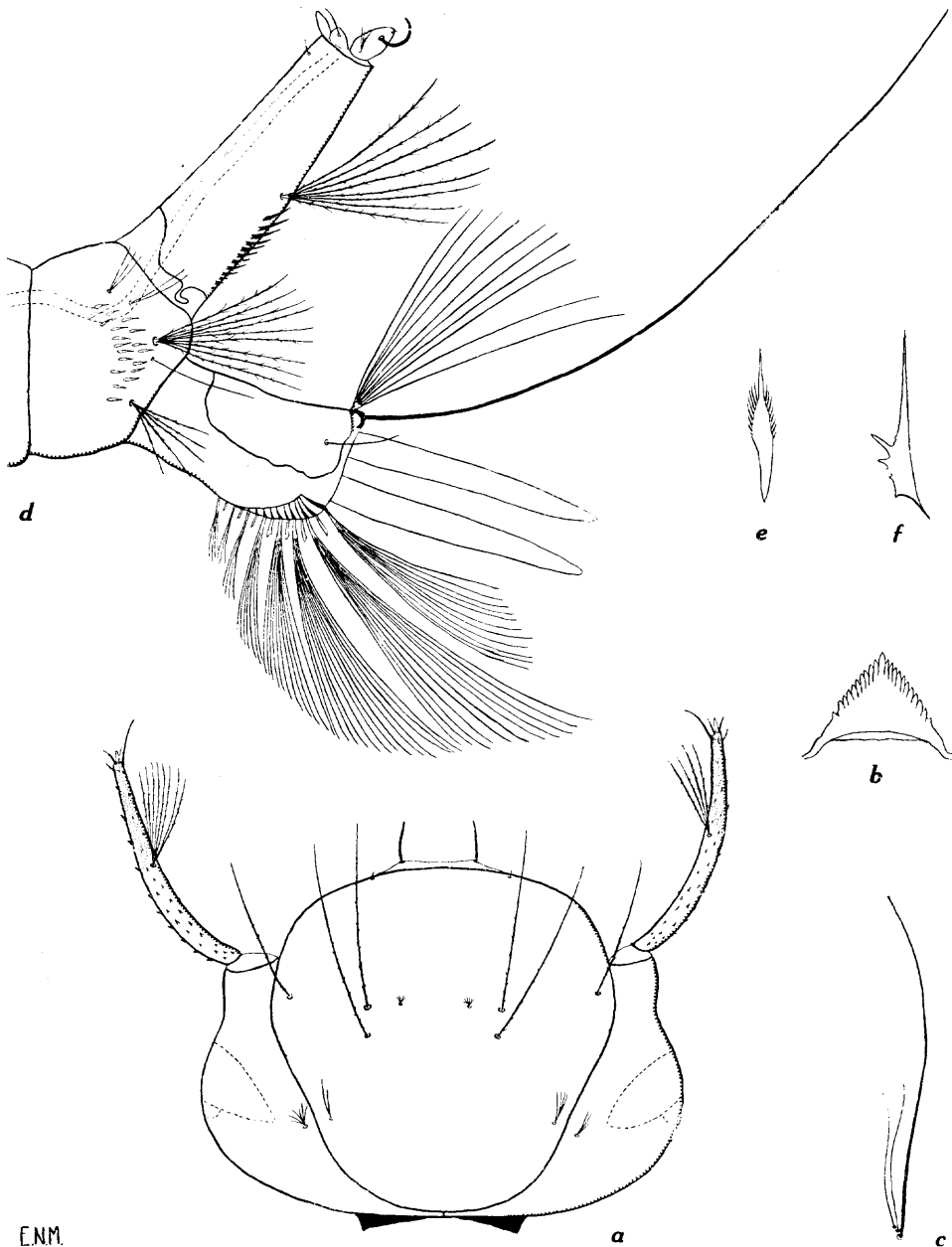


FIG. 12—Larva of *Aedes pseudonormanensis* n.sp. *a*, head; *b*, mentum; *c*, submedian prothoracic setae; *d*, terminal segments; *e*, lateral comb tooth; *f*, pecten tooth. (*a* and *d*, x 56; *b*, x 145; *c*, x 66; *e* and *f*, x 290).

Anal Segment: Saddle covering about  $\frac{1}{2}$  segment, with irregular ventral margin and with a few small fringed spicules dorsally at apex. Lateral seta single, simple, about  $\frac{1}{2}$  length of saddle. Dorsal subcaudal setae simple, upper 10–14 branched,

about twice length of saddle, lower single, 3 times length of upper. Ventral brush of 12-15 multiple tufts, each with about 13 branches, arising from a grid, except the basal 2-3 which are precratal. Gills long, pointed, the lower pair about 2 x saddle, the upper slightly shorter.

Description based on 6 whole larvae, 3 from Eidsvold and 3 from Mareeba.

A single larva from Clermont differs in having head seta A 3 branched and C bifid, lateral seta on abdominal segments III and IV may be bifid, and subventral tuft of siphon 10-11 branched.

*Biology*: Mackerras (1927) bred this species from a muddy rock pool, and a waterhole in the bed of a sandy creek. Specimens examined from Mareeba were from rock pools. At Clermont, the larva was found in clear fresh water in an earthen drain at the side of a country road, fully exposed to the sun; the water was from recent rain and larvae were found mainly around scattered grass tufts. Theodore specimens were bred from larvae found in muddy water, 6 inches deep, in a slit trench in the township; there was long grass around the trench, and hardly any sunlight reached the water; associated species were *A. annulipes* and *Culex (Culex) fatigans* (Wied.).

*Habits*: Mackerras' (1927) records of *A. normanensis* almost certainly refer to this species. He described it as a day biting forest species numerous at Eidsvold in the later half of the summer but rare earlier in the season.

*Distribution*: Specimens have been examined from the following localities in Queensland: Eidsvold, 3 ♂♂, 5 ♀♀, larvae (I. M. Mackerras, xii.1922); Theodore, 2 ♀♀ (R. Connellan, 29.ix.1943); Clermont, 1 ♀, larva (J. L. Wassell, 10.xii.1947); Mareeba, 1 ♂, larvae (F. H. S. Roberts, 2.i.1943); Inverleigh, 1 ♀ (F/Sgt. Childe, viii.1944). Mareeba specimens and Eidsvold larvae are in C.S.I.R. Collection.

### (7) *AÈDES (OCHLEROTATUS) PERKINSI* n. sp.

*Types*: Holotype ♂ (with correlated larval and pupal skins), Caloundra, Queensland, 13.viii.1945, F. A. Perkins and J. L. Wassell; one paratype ♂ (with correlated larval and pupal skins) and one morphotype larva, same data as holotype; all deposited in the University of Queensland collection. This species is named after its co-discoverer, Mr. F. A. Perkins, Lecturer in Entomology in the University of Queensland and Secretary of the Mosquito Control Committee, whose stimulating interest and sound advice have been of the greatest assistance in the preparation of the present series of papers.

*Distinctive Characters*: This species is distinguished by the combination of banded tarsi and dark scaled wings from all Australian *Ochlerotatus* except *rubrithorax* and *camptorhynchus*, differing from both these in having unbanded ♂ palpi. The tibiae of *camptorhynchus* are mottled; *rubrithorax* has unmottled femora and complete basal bands on the ♂ abdominal tergites.

♂ *Genitalia*: Coxite with well developed apical lobe and rounded basal lobe bearing 6 long recurved setae; harpago without sub-basal thumb, appendage  $1\frac{1}{2}$  times length of harpago, expanding gradually at  $\frac{1}{3}$  its length, bluntly pointed.

*Larva*: Head setae B 3-4 branched, C 3-5 branched, d small, 4-6 branched; A, B and d arising in a straight line, and C directly behind B. Lateral comb of 20-23 pointed spines, finely fringed at base. Siphonal index 3.7; pecten of 25-30 spines, each with 4-5 lateral denticles extending slightly less than half length of siphon.

*Description of Adult :**Holotype* ♂

Wing length 4.1 mm.

*Head* : Integument brown, clothed with narrow curved creamy scales medially and flat white scales laterally; upright forked scales creamy; a tuft of about 8 strong pale vertical setae and a row of about 5 dark medially directed ocular setae, with shorter ones laterally. Torus dark brown; flagellar segments of antenna brown with dense dark verticillate hairs. Clypeus dark brown. Palpi about equal in length to proboscis, black scaled, with long dense dark hairs on segments IV and V and apex of III. Proboscis about  $1\frac{1}{3}$  times length of fore femur, black scaled; labella dark.

*Thorax* : Mesonotum with reddish brown integument clothed mainly with rather large narrow curved pale golden and creamy scales and with some fine narrow curved black scales. There is no definite pattern, but the dark scaling is mainly confined to the area between the dorsocentral bristles, and the creamy or whitish scaling to a patch of large sickle-shaped scales surrounding the prescutellar bare area. There is a double row of small dark acrostichal bristles; about 6 slightly larger dark dorsocentral; a double row of about 8 long pale prescutellar; a patch above wing roots and other scattered bristles laterally and on fossae. Scutellum light brown with large creamy sickle-shaped scales on all lobes; border bristles pale, about 8-10 to each lobe. Metapostnotum light brown.

Pleura brown. Anterior pronotum with large narrow curved pale golden scales and a few elongate broad scales below. Posterior pronotum with narrow curved pale golden scales along its upper margin, narrow curved black scales below these and elongate broad white scales at its lower margin. Patches of elongate broad, semierect white scales on sub- and postspiracular areas, paratergite, upper sternopleuron, along lower posterior margin of sternopleuron, on prealar area, and on upper and lower halves of mesepimeron; rather narrower elongate white scales on propleuron. Bristles pale; about 35 propleural, 8-12 posterior pronotal, 7-11 postspiracular, about 5-6 upper and 11-12 lower sternopleural, about 18 prealar, about 20 upper and no lower mesepimeral bristles.

*Legs* : Dark scaled with basally banded tarsi. Coxae brown, fore and mid with patches of white scales. Trochanters white scaled. Fore leg: Femur dark with mottling of white scales anteriorly, white scaled beneath and with small pale knee spot; tibia dark dorsally, white beneath; tarsal segment I pale beneath on basal half, I-V with narrow basal white bands or patches. Mid leg: Femur as in fore leg but ventral white scaling forms only a narrow streak apically, knee spot is larger and continuous with dorsal white patch at base of tibia; tibia otherwise dark except for fringe of pale scales at apex; tarsal segments I-V dark with narrow basal white bands. Hind leg: Femur pale on basal half, with dorsal mottling of dark scales which continues into a streak, broadening on apical half to form a complete dark ring near apex; prominent pale knee spot; tibia as on mid leg; tarsal segments I-V with white basal bands covering  $\frac{1}{10}$  I,  $\frac{1}{10}$  II-V. Claws of fore and mid legs unidentate, unequal, the anterior claw being the longer; hind claws equal, unidentate.

*Wings* : Black scaled; outstanding scales all long and narrow. Cell  $R_2$   $1\frac{1}{3}$  times length of its stem; cell  $M_1$   $\frac{2}{3}$  length of its stem, its base slightly proximal to that of cell  $R_2$ ;  $r-m$   $\frac{2}{3}$  its length distal to base of  $M_{3+4}$ . Halteres with pale stem and dark knob clothed with small white scales.

*Abdomen* : Integument brown. Tergites with numerous long pale golden setae along lateral margins, sparser along apical margins; similar setae scattered over the sternites. Tergite I with a few white scales medially and lateral white patches. Tergites II–VII purplish black scaled with small lateral basal white patches, extending medially but not forming complete basal bands. Sternites II and III white scaled, IV–VII white scaled laterally with longitudinal medial dark stripe and dark apical border. Segment VIII dark dorsally with lateral basal white patches; mainly white scaled with scattered dark scales ventrally.

The ♂ paratype shows the following main differences from the holotype : Wing length 3.6 mm. Proboscis  $1\frac{1}{2}$  times length of fore femur. Posterior pronotum with pale scales only; 5–6 postspiracular and about 12 upper mesepimeral bristles. Mid femur with ventral white scaling not reaching to apex; hind tibia without pale scales at apex. Wing : cell  $R_2$   $1\frac{1}{2}$  times length of its stem, cell  $M_1$   $\frac{4}{5}$  length of its stem,  $r-m$  less than  $\frac{1}{2}$  of its own length distal to base of  $M_{3+4}$ .

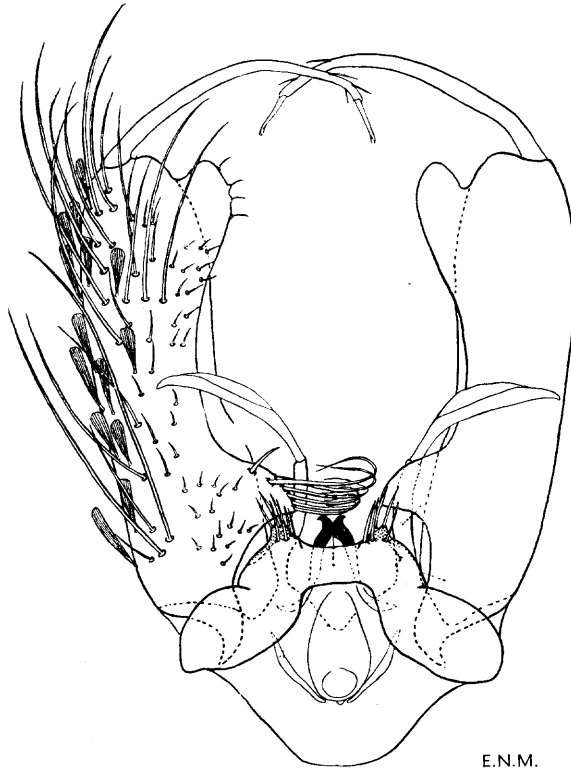


FIG. 13—♂ genitalia of *Aedes perkinsi* n.sp., x 127.

♂ *Genitalia* : (Fig. 13)

Coxite black scaled, about  $4\frac{1}{2}$  times as long as mid width, with well developed apical lobe projecting medially, which is bare of setae tergally but with some fine setae on its medial and sternal aspects. The basal lobe is rounded and bears a row of about 6 long medially directed setae, each with its apical third curving back towards its base; distal to this row is a single short stout pointed seta; the lobe bears numerous fine setae on its sternal aspect. Tergally the coxite bears numerous

short fine setae near its base and along its inner aspect; laterally and apically there are numerous long strong setae; sternally there is a medially directed row of about 30 long setae, extending from base to apex of coxite. Style  $\frac{3}{5}$  length of coxite, slender, slightly curved and tapering, pilose, with 2-3 short fine preapical setae; terminal appendage straight, about  $\frac{1}{6}$  length of style, with grooved tip. Harpago stout, pilose, with several fine setae near its base; appendage about  $1\frac{1}{2}$  times length of harpago, widening gradually at  $\frac{1}{3}$  from its base into a lateral membranous expansion which tapers off a short distance from its rather blunt tip. Paraproct with a single tooth. Phallosome simple, oval. Lobes of IXth tergite with 3-8 setae; IXth sternite with about 5 setae.

The genitalia of *perkinsi* resemble closely those of *camptorhynchus*. The latter<sup>1</sup> is distinguished by the basal lobe which bears one straight stout pointed seta, 1-2 shorter similar setae and numerous fine setae; also by the appendage of the harpago which is slender on its basal half, widening fairly sharply at mid length, whence it tapers to a slender pointed tip; it is about  $1\frac{1}{2}$  times length of harpago, Mackerras' (1927) figure apparently giving a foreshortened view.

*Description of Larva* : (Fig. 14)

Length about 9.8 mm. Colour brown, with lightish brown head, siphon and saddle, apical  $\frac{5}{8}$  of antennae very dark.

*Head* : About  $\frac{2}{3}$  as long as broad. Antenna about  $\frac{1}{2}$  length of head, 8-10 times as long as broad at base, slightly curved and tapering, clothed with numerous moderately long spicules; tuft 6-9 branched, finely frayed, about  $\frac{1}{2}$  length of antenna, at almost  $\frac{1}{2}$  from base; terminal and subterminal setae close together, the outer subterminal almost  $\frac{1}{3}$  length of antenna. Clypeal spines fairly fine, pointed and slightly curved. Setae A, B and C finely frayed, almost as long as antenna; A 5-8 branched, arising just behind base of antenna; B 3-4 branched, arising level with A and a little more than half way between A and midline; C 3-5 branched, arising a short distance from and directly behind B; d very small, simple, 4-6 branched, arising level with and medial to B; e and f 2-3 branched, long, fine and simple. Mentum triangular with medial tooth and 11-13 even lateral teeth. Inner setae of the mouthbrushes strongly pectinate.

*Thorax* : Base of metapleural setae with several short spines.

*Abdomen* : Two pairs of long finely frayed lateral setae on segment I, the upper bifid, the lower single; one pair on segments II-VI, bifid on II and single on III-VI.

8th Segment : Lateral comb a patch of 20-23 fairly large, tapering, pointed spines, inconspicuously fringed at their base, forming 2-3 rows. First pentad seta 5-6 branched, long and finely plumose; second and fourth bifid, simple; third 9-10 branched, long, plumose; fifth 6-8 branched, long, simple or inconspicuously frayed.

Siphon : Index about 3.7, slightly tapering. Pecten extending over slightly less than  $\frac{1}{2}$  length of siphon, consisting of 25-30 evenly spaced pointed spines, each with about 4 or 5 pointed lateral denticles basally, of which the apical or preapical is the largest; the pecten spines diminish in size towards base of siphon. Subventral tuft 5-7 branched, finely frayed, arising a short distance beyond end of pecten. Acus present.

Anal Segment : Saddle covering dorsal  $\frac{2}{3}$  of segment, without apical spines, but clothed with very fine spicules. Lateral seta single, simple, equal in length

<sup>1</sup>Notes on genitalia of *A. camptorhynchus* are based on 2 ♂♂ from Roleystone, W.A., and one ♂ from Fremantle, W.A. (A. W. Wilson, v. 1944).

E.N.M.

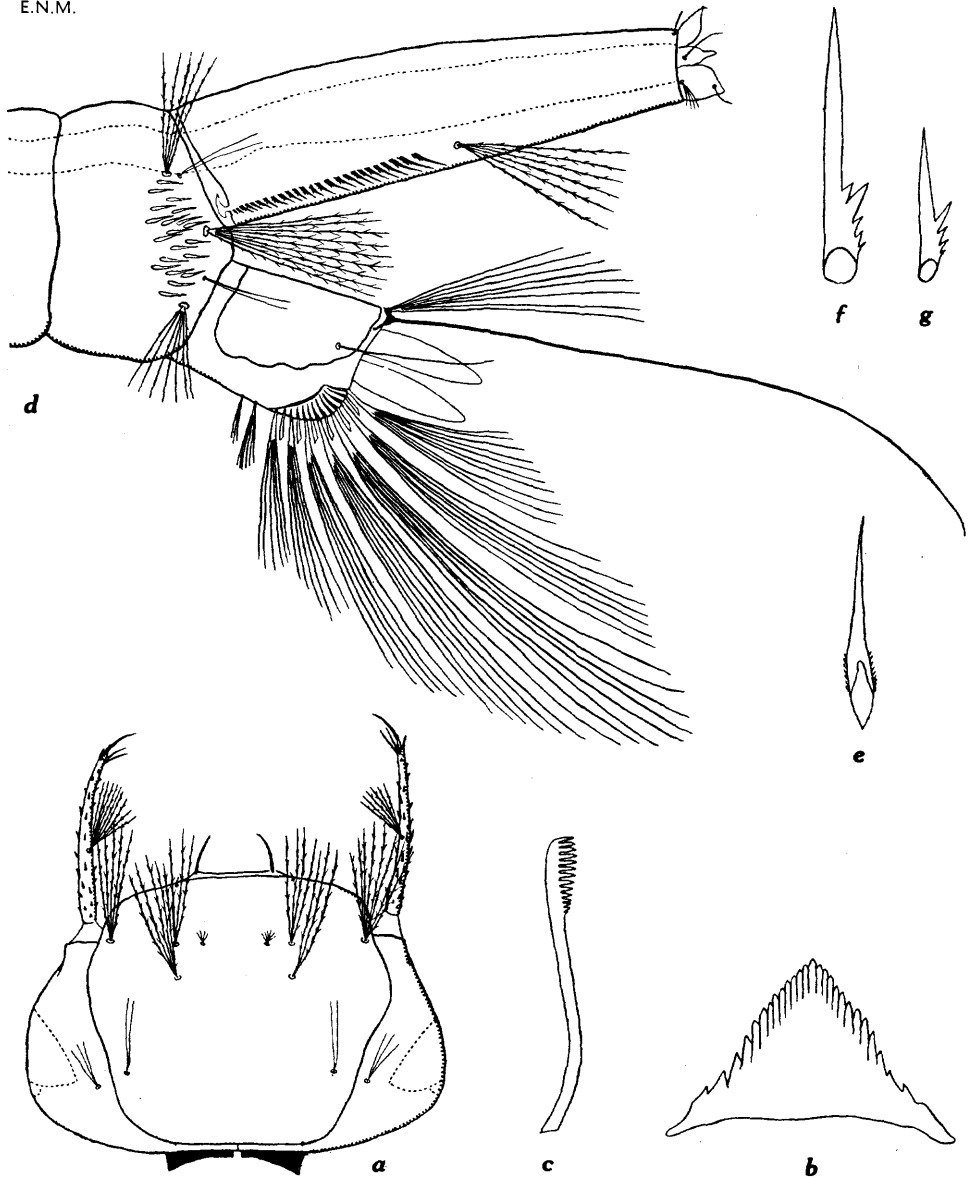


Fig. 14—Larva of *Aedes perkinsi* n.sp. a, head; b, mentum; c, seta from mouthbrush; d, terminal segments; e, lateral comb tooth; f and g, pecten teeth from near apex and base, respectively. (a and d, x 38; b, x 145; c, e, f and g, x 290).

to saddle. Dorsal subcaudal setae simple, upper 7–10 branched, about twice length of saddle; lower long, single, three times length of upper. Ventral brush of 16–18 multiple tufts, each with 6–12 branches, arising from a grid except the basal one or two which are precratal. Gills equal, bluntly pointed, slightly shorter than saddle.

Description based on one whole larva and two larval pelts correlated with the holotype and paratype.

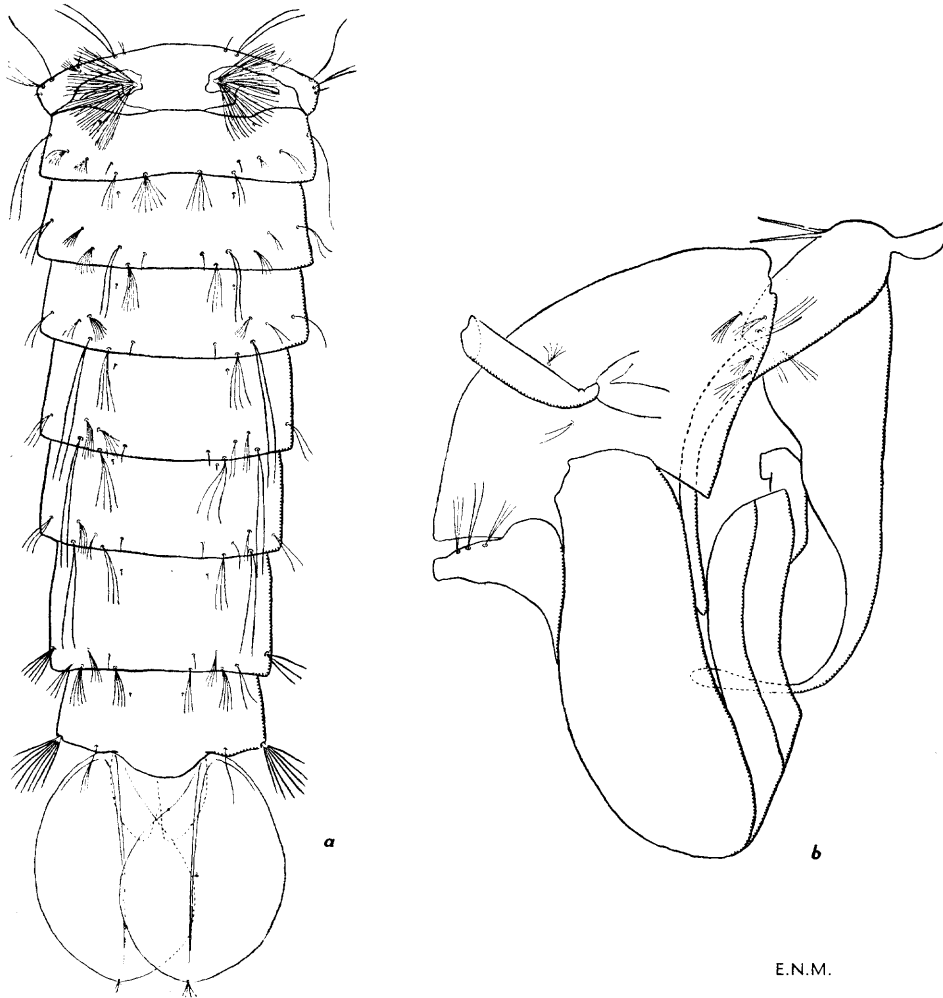


FIG. 15—Pupal pelt of *Aedes perkinsi* n.sp., x 25. *a*, abdomen (dorsal view) ; *b*, cephalothorax.

*Description of Pupa* : (Fig. 15)

General coloration brown.

*Cephalothorax* : Pigmentation lighter anteriorly. Trumpet evenly pigmented, moderately long (about 4 times as long as its greatest width), cylindrical, narrowing at base; opening oblique, ratio of meatus to whole 1 : 1.2, apical notch shallow.

*Abdomen* : Float setae dendritic, with about 20 branches. Abdominal setae simple, except lateral seta of segment VIII which is weakly plumose, short, 7-8 branched. Paddles oval (breadth index 1.6) with finely denticulate margin and rounded apex; buttress and midrib moderately developed; paddle seta short, 2-4 branched.

Description based on two pupal pelts correlated with holotype and paratype.

*Biology*: Larvae of this species were taken from peaty swamp pools in open heath country on 13th August, 1945. It is possible that the pools in which it was breeding were filled by heavy rain which fell 4 weeks previously, but there had been sufficient rain to keep deeper pools in this area filled since the middle of April, and no distinction in depth of pools was made at the time of collection. No larvae of *perkinsi* were found on 23rd August, at which date the shallower peaty pools had dried out.

The pupal period occupies 4-5 days.

*Habits*: Nothing is known of the habits of this species.

*Distribution*: Known only from the type locality, a heath swamp about 5 miles from Caloundra, South Queensland, on the Caloundra-Landsborough road.

### (8) *AÈDES* (*OCHLEROTATUS*) *STRICKLANDI* (Edwards).

*Grabhamia australis* Strickland, 1911, *Entomologist*, 44 : 133 (nec *C. australis* Erichson).

*Ochlerotatus stricklandi* Edwards, 1912, *Ann. Mag. Nat. Hist.*, (8), 9 : 523.

*Grabhamia flindersi* Taylor, 1914 a, *Trans. ent. Soc. London*, 1913 : 686.

*Aedes* (*Ochlerotatus*) *stricklandi* Edwards, 1924, *Bull. ent. Res.*, 14 : 377 ; Mackerras, 1927, *Proc. Linn. Soc. N.S.W.*, 52 : 290.

*Type*: The type of *A. stricklandi* is the single female in the British Museum, described by Strickland as *Grabhamia australis*. *Grabhamia flindersi* was described from two female specimens (one being designated the type) in the collection of the School of Public Health and Tropical Medicine, Sydney. Mackerras (1927) referred to an additional female from Mt. Compass which is in the Macleay Museum. No other specimens have been recorded. A single male in the Queensland Museum collection is from Perth near the type locality of *stricklandi* and, though differing in some characters from the published descriptions, apparently belongs to the same species.

*Distinctive Characters*: This is the only known Australian species of the subgenus *Ochlerotatus* which possesses the combined characters of unbanded tarsi and mottled wing scales. The legs are mottled with pale scales and there may be traces of indistinct white bands at the bases of hind tarsal segments I-III. The broad wing scales, extensively mottled with white scales, give a superficial resemblance to species of *Taeniorhynchus* (*Mansonioides*). The dark brown scales of the mesonotum and upper portion of anterior and posterior pronota form a sharp contrast with the extensive white scaling of the remainder of the pleura.

*Male Genitalia*: Coxite with well developed apical and reduced basal lobes ; harpago without sub-basal thumb but with preapical seta, and with short, broad, square-ended, leaf-like appendage.

#### *Description of Adult ♂*:

The head scaling is similar to the female. The tori are large and dark, antennae about  $\frac{1}{2}$  length of proboscis with dense dark verticillate hairs. Palpi slightly longer than proboscis, black scaled, with extensive mottling of white scales ; long dense dark hairs on apical half of segment III and on segments IV and V, the latter two upturned. Proboscis dark, mottled with white scales, long and slender, over  $1\frac{1}{2}$  times length of fore femur.

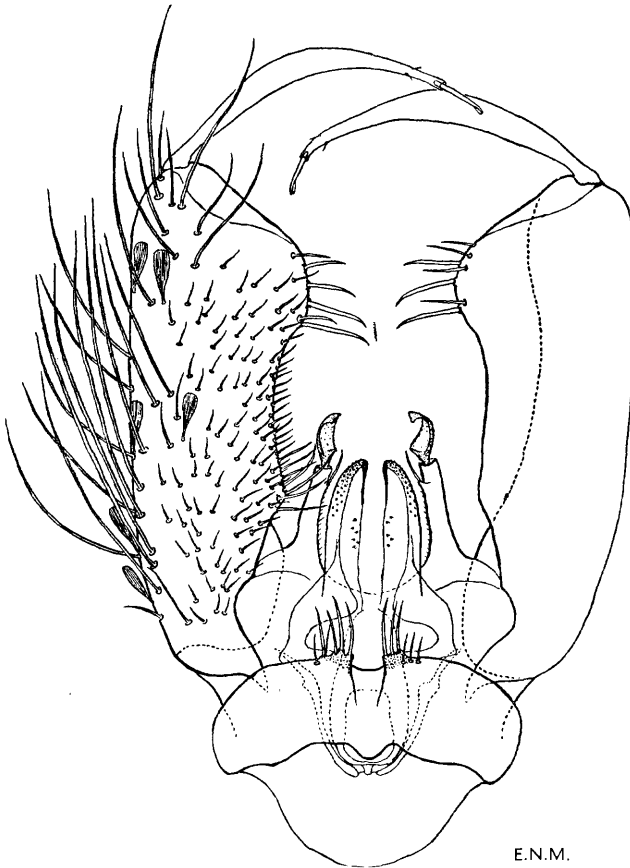
*Thorax*: As in the female except that the dark chocolate scaling of the mesonotum (which is largely denuded) has an admixture of paler golden scales in a broad area along the lateral margins. There are no lower mesepimeral bristles though there may be the base of one on one side.

*Legs*: Dark, mottled with white scales on femur, tibia and first and second tarsal segments and with traces of narrow indistinct white rings at the base of

hind tarsal segments I and II (hind tarsal segments III–V missing). Claws of fore leg subequal, the shorter simple, the longer with a strong tooth; of mid leg, markedly unequal, the shorter with a strong tooth, the longer swollen near base but without tooth.

*Wing*: Length 5.5 mm. There are broad triangular scales on *C*, *Sc*, *R*<sub>1</sub>, *Rs* and basally on *M* and *Cu*<sub>1</sub>, the remainder of the veins bearing only scattered scales (possibly denuded). The scaling is dark, with extensive mottling of pale scales on all veins. Cell *R*<sub>2</sub> slightly longer than its stem, cell *M*<sub>1</sub>  $\frac{2}{3}$  length of its stem, its base proximal to that of cell *R*<sub>2</sub>; *r-m*  $\frac{1}{3}$  its length distal to base of *M*<sub>3+4</sub>. Halteres with pale stem and dark knob bearing dark and pale scales.

*Abdomen*: Tergite I bare of scales dorsally but with lateral basal white patches; tergites II–VIII dark scaled, mottled with white scales dorsally, and without lateral white patches. There are no apical white bands or patches such as occur in the female, nor do the dark scales appear paler on the apical segments. The venter is similar to the female, being white scaled mottled with black.



E.N.M.

FIG. 16—♂ genitalia of *Aedes stricklandi* Edwards, x 127.

♂ *Genitalia*: (Fig. 16)

Coxite black scaled, about  $3\frac{1}{2}$  times as long as mid width, broadening on its inner aspect towards the apex into a prominent rounded apical lobe which bears

6-7 short broad medially directed setae, 3 or 4 of which are larger than the others. Basal lobe reduced to a slight broadening of the coxite, bearing about 6 setae slightly longer than those of surrounding area. Tergally the coxite is clothed with numerous short fine setae, with a lateral longitudinal row of 6-8 long strong setae and a group of about 5 long and several shorter setae apically. Laterally there are additional long setae and sternally there are scattered setae on the basal half and a group of about 6 very long setae near the apex. Style slightly curved, about  $\frac{2}{3}$  length of coxite, finely pilose, broadening a little from base to mid length, then tapering, with 2 short fine preapical setae; terminal appendage short and straight, about  $\frac{1}{7}$  length of style, with small rounded flange at tip. Harpago stout, pilose, with a slender preapical seta arising from a small raised boss on its inner aspect; appendage less than  $\frac{1}{2}$  length of harpago, narrow at base, but broadening abruptly, and in shape like a curved and cupped square-ended leaf. Paraproct without prominent teeth but with numerous minute denticles towards apex. Phallosome simple, pear-shaped. Lobes of IXth tergite with 2-3 large stout setae and 3-4 smaller setae; IXth sternite with 7 fine setae.

*Adult* ♀:

A single female of this species in C.S.I.R. Museum, from Lower Tarwin, Victoria, has wing length 5.4 mm. It differs from those described in having a few scattered white scales medially on the palpi. There is a single mesepimeral bristle separate from the upper patch, situated near the middle of the anterior border. Femora of all legs are more extensively pale, with sparse mottling of dark scales; there are indefinite basal bands or patches at base of fore tarsal segments I-II and mid and hind tarsal segments I-III and there is a slight mottling of pale scales on hind tarsal segments III-IV; claws of hind leg are equal and simple.

*Biology and Habits*: Nothing is known concerning these.

*Distribution*: WESTERN AUSTRALIA: Serpentine, Darling Range, near Perth (J. B. Cleland, 21.x.1906)—a single female, the type of *Grabhamia australis*; Perth (A. J. Turner, 6.ix.1938)—a single male described above; SOUTH AUSTRALIA: Mt. Compass (J. B. Cleland, 27.x.1920); BASS STRAIT: Flinders Island (J. B. Cleland, 20.xi.1912)—two females, one the type of *Grabhamia flindersi*. VICTORIA: Lower Tarwin (G. F. Hill, xi.1925).

#### ACKNOWLEDGMENTS

The loan of specimens from the C.S.I.R. Museum, Macleay Museum and School of Public Health and Tropical Medicine, Sydney, has been of the greatest assistance in the preparation of this paper and the author is indebted particularly to Messrs. T. G. Campbell and D. J. Lee who were instrumental in obtaining these specimens for her, and also to the Director of the Queensland Museum for permission to examine specimens in that institution. Data on rainfall was supplied by courtesy of the Divisional Meteorologist, Mr. A. S. Richards. Thanks are due for their valuable field collections to Mr. J. L. Wassell, to the Health Inspectors at St. George (Balonne Shire) and Longreach and to members of the State Schools at Dunwich, Broadwater, Theodore, Normanton and Croydon, as well as to the numerous other collectors whose names appear in the text. The success of the studies undertaken at Dunwich was in large measure due to the enthusiasm of the Head Teacher, Mr. L. J. Callaghan, and the generous hospitality provided by Mr. and Mrs. Callaghan was greatly appreciated.

## REFERENCES

- BANCROFT, T. L., 1908. *Ann. Q'land Mus.*, 8 : 1-64.
- EDWARDS, F. W., 1912. *Ann. Mag. Nat. Hist.*, (8), 9 : 521-527.
- 1924. *Bull. ent. Res.*, 14 : 351-401.
- 1932. *Genera Insectorum. Family Culicidae. Fasc. 194.*
- FERGUSON, E. W., 1926. 15th Rept. Microbiol Lab., N.S.W., for 1924 : 187-191.
- HOPKINS, G. H. E., 1936. *Mosquitoes of Ethiopian Region, Part I, British Museum.*
- KNIGHT, K. L., 1948. *Proc. ent. Soc. Washington*, 50 : 1-8.
- LEE, D. J., 1944. *Atlas of Mosquito Larvae of the Australasian Region. Australian Military Forces (Restricted).*
- MACKERRAS, I. M., 1927. *Proc. Linn. Soc. N.S.W.*, 52 : 284-298.
- STRICKLAND, E. H., 1911. *Entomologist*, 44 : 130-134.
- TAYLOR, F. H., 1914 a. *Trans. ent. Soc. London*, 1913 : 683-708.
- 1914 b. *Proc. Linn. Soc. N.S.W.*, 38 : 747-760.
- 1915. *Ibid.*, 40 : 176-184.
- 1919. *Ibid.*, 43 : 826-843.
- THEOBALD, F. V., 1903. *Monog. Culicidae, Vol. III.*
- 1907. *Ibid.*, Vol. IV.