

NOTES ON AUSTRALIAN MOSQUITOES (DIPTERA, CULICIDAE). II.

NOTES ON ANOPHELES STIGMATICUS SKUSE AND DESCRIPTION OF NEW SPECIES OF ANOPHELES FROM AUSTRALIA AND NEW GUINEA.*

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(Three Text-figures.)

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Synopsis.

Notes on *Anopheles stigmaticus* Skuse are given and the pupa is described. The adults, pupa and larva of the closely related *Anopheles pseudostigmaticus*, n. sp., are described from Victoria and notes are given on its biology and distribution. The adults, pupa and larva of *Anopheles papuensis*, n. sp., from New Guinea are described.

INTRODUCTION.

Anopheles stigmaticus Skuse has been recorded as having a wide distribution from New South Wales through Queensland to New Guinea. It is clear, however, that, in the past, a number of closely allied forms have been confused under this name. Thus in an account of this complex in Queensland, Marks (1956) recognized five components: four of these, pending further investigation, were not given taxonomic status; but the fifth was described as a new species, *Anopheles collegei*.

New Guinean "*stigmaticus*" larvae showing morphological differences from Australian forms have been recorded by Soesilo (1933) and by Bonne-Wepster and Swellengrebel, and material from Minj, kindly sent to me by Mr. S. H. Christian, has proved to be a distinct species. In some morphological traits the larvae do not conform to the types found by the above authors, so that it is probable that more species or subspecies of the complex from New Guinea have yet to be described.

The "*stigmaticus*" complex also extends southwards into Victoria and Tasmania. In Tasmania only one species has so far been found but in Victoria there are two.

Most members of this complex are restricted to mountainous country at altitudes up to 6,000 feet; those that occur in coastal plains breed only in shaded situations. In southern Australia the water temperature of the breeding sites seldom exceeds 20°C.; Dr. Marks (personal communications) states that this also applies in Queensland.

The "*stigmaticus*" complex in Victoria.—When "*stigmaticus*" was first discovered in Victoria in 1954, two types of larvae were found; one ("striped" form) is characterized by the presence of a black longitudinal stripe along the dorsal side of the thorax and abdomen; the other ("brown" form) is coloured uniformly brown. There are small but constant morphological differences between the two types of larvae and also between the pupae and adults. Usually the two forms do not occur in the same localities.

However, at one place, Maroondah, they are found together in the same breeding sites, and investigations here have provided valuable evidence that they are distinct species.

Maroondah is situated in the Hume Range at an elevation of about 1,500 feet. The breeding sites are provided by a small stream which, running in a densely vegetated valley, emerges into a clearing where it forms a shallow, grassy swamp. The creek runs freely during the late autumn, winter and early spring, but during the summer dries out, leaving only a few deep pools. Here, owing to the heavy shade, the water temperature does not exceed 13°–14°C. These pools provide the breeding place for the "striped" form.

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The swamp is fully exposed to the sun; an occasional stack of logs or tall grass provides the only shade. On hot days the water temperature rises to 20°–25°C. The edges of the swamp are the breeding places for the "brown" form.

After the autumn rains, however, the pools in the stream bed are flooded out and larvae of the "striped" form are carried down to the swamp. Here, during the winter months, both types of larvae are temporarily found together.

Laboratory experiments have shown that the two types of larvae have different ranges of lethal temperatures. The 50% lethal temperature with five minutes' exposure for the "striped" form is 37°–37.5°C., for the "brown" form, 39°C. An exposure of six hours at 33°C. is fatal to the "striped" form but not to the "brown" one. It is probable that selection of breeding sites is strongly influenced by temperature preferences.

At Maroondah, therefore, the two forms are found in the closest association but, though large numbers of adults and larvae have been examined, no intermediates have been found. Evidently they are reproductively isolated and can be treated as distinct species.

ANOPHELES STIGMATICUS Skuse.

Skuse, F. A., 1889, PROC. LINN. SOC. N.S.W., 3:1759.

I have examined the type series (Macleay Museum, Sydney), which consists of one male and one female. Both are faded with some legs missing and, unfortunately, have been mounted on card triangles so that only one side can be examined. Nevertheless, some important morphological traits are recognizable, particularly in the male: the upper part of the sternopleuron has two bristles, the haltere has a dark scaled knob, the ventral lobe of the harpago has four setae and the longest leaflets of the phallosome are curved. In the type female only one seta can be recognized on the upper part of the sternopleuron; the haltere has a dark scaled knob.

This examination of the type material has shown that the Victorian species referred to above as the "striped" form is in fact *Anopheles stigmaticus* Skuse.

It seems to me necessary to point out some morphological traits which are important for distinguishing this species from the closely related *A. pseudostigmaticus*, n. sp., because in descriptions of *A. stigmaticus* Skuse (I. Mackerras, 1927; Lee and Woodhill, 1944) apparently both species were used and some important features were not mentioned.

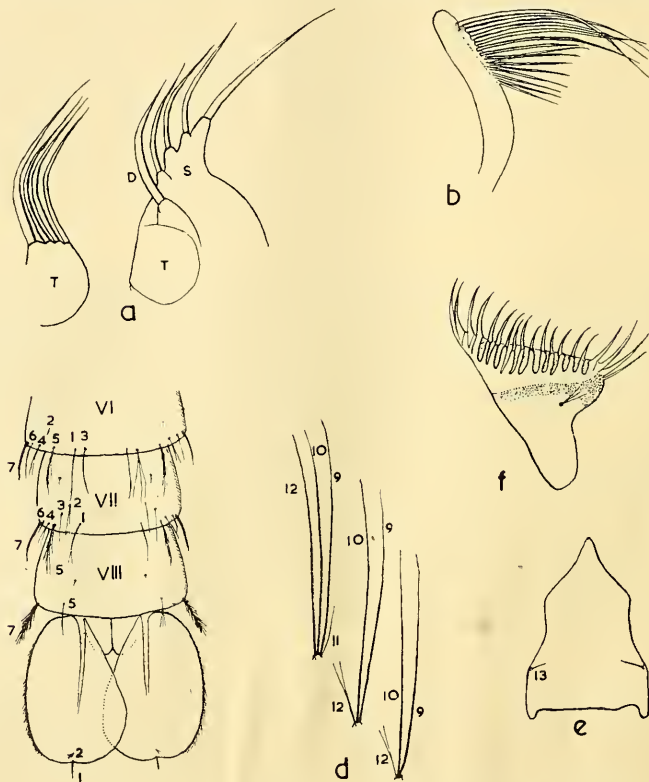
Distinctive Characters: Adult with basal 0.7–0.8 of hind femur pale. Two or more upper sternopleural bristles. Knob of haltere black scaled. Abdomen brown, segments VII and VIII usually paler. Ventral lobe of harpago with four setae (Text-fig. 1, a). Longest leaflets of phallosome curved (Text-fig. 1, b). Larva pale with black longitudinal stripe dorsally on thorax and abdomen. Pro-, meso- and meta-thoracic setae 9 and 10 single, simple (Text-fig. 1, d). Valve seta 13 very short (Text-fig. 1, e). Pecten with 17–19 spines (Text-fig. 1, f).

Descriptive notes: Adult: Fourth segment of female palps about 1.6 times as long as fifth. Male proboscis about 1.7 times length of fore-femur, and 1.3 times length of fore-tibia. Female proboscis equal to fore-femur and about 0.9 of fore-tibia. Sternopleuron has 1 strong, and 1–3 weaker upper bristles and 2–3 lower bristles; 4–5 pre-alar and 4–8 upper mesepimeral bristles. There is a conspicuous darkening of the wing membrane near tip of Sc. Cell R₅ 1.1–1.3 times the length of its stem in male and 1.1–1.2 times its length in female. Wing length: ♂♂ 3.6–3.9 mm., ♀♀ 3.6–5.0 mm. Halteres have pale stem and black scaled knob. Abdomen dark brown, except segments VII and VIII, which are paler. Ventral lobe of harpago with four setae. Phallosome with about 15–17 pairs of slender, smooth leaflets, the longest curved.

Pupa: Trumpet broad, triangular. Abdomen (Text-fig. 1, c): Segment VI: seta 1 single or 2–3-branched, half length of segment, slightly longer than 5; seta 2 short, single or 2-branched; seta 3 single, slightly shorter than 1; seta 4 fine, 2-branched; seta 5 stout, slightly plumose; seta 6 fine, single, as long as 4; seta 7 a short spine. Segment VII: seta 1 long, single or 2-branched; seta 2 shorter, single or 2-branched; seta 3 single, as long as 2; seta 4 short, single, or 2-branched; seta 5 slightly longer than 1, slightly plumose; seta 6 very short, single; seta 7 a short spine. Segment VIII;

seta 5 fine, single or 2-3-branched; seta 7 plumose. Paddle with short fringe; seta 1 single, stout, simple; seta 2 small, fine, 2-4-branched.

Larva: Pale with black dorsal longitudinal stripe on thorax and on abdominal segments I-VI. Head, in young larvae, black, in IV stage, dark brown. Antennal seta 1 short, 3-4-branched; seta 4 single. Metathoracic seta 1 plumose with about 12 slender leaflets. Segments I-VII of abdomen with narrow transverse tergal plate; behind this, on segments I-VII or III-VIII, a pair of small plates, sometimes a second

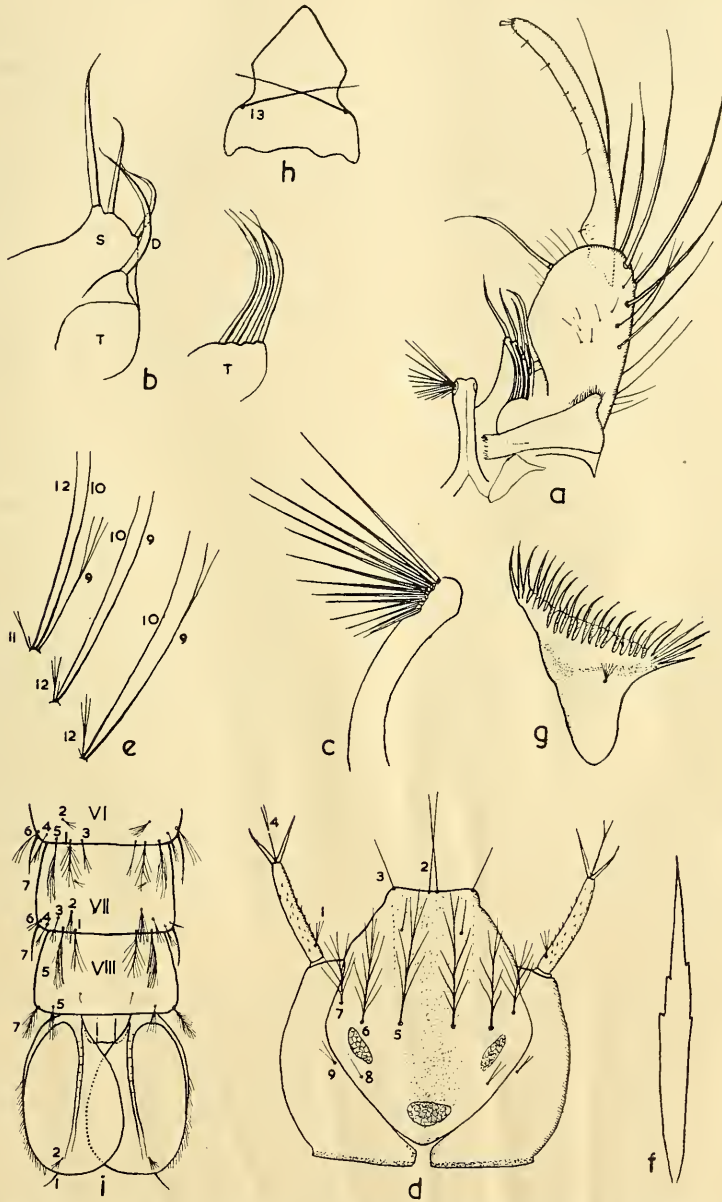


Text-fig. 1.—*Anopheles stigmaticus* Skuse. Male terminalia, *a*, harpago; *b*, phallosome; *c*, pupa, dorsal view of terminal abdominal segments; larva, *d*, pro-, meso- and metathoracic pleural setae; *e*, median plate of scoop; *f*, pecten.

pair and sometimes a small median plate just behind the large transverse plate. Pecten with 17-19 spines. Median plate of scoop broadened posteriorly; seta 13 single, very short.

Biology: *A. stigmaticus* is a homodynamous species. It breeds in cold, clean water, shaded by trees, and is confined to mountainous areas. The larvae have been collected in stream-fed pools, at the edges of slowly running creeks, in pits in drying-out creeks and in rock pools. Usually it breeds in association with *Aë. queenlandis* Strickland, *T. inconspicua* Lee and sometimes *A. annulipes* Walker. During the winter, larvae of *A. stigmaticus* may be washed down by floods from the usual breeding sites, and can then be found in association with *A. pseudostigmaticus*, n. sp., and species which associate with it. No adults have been taken biting, but in the laboratory they oviposit after a human-blood meal. At laboratory temperature only a few eggs hatched, but the remainder hatched immediately after the temperature of water was lowered to 10°-13°C. There is here a striking resemblance to some species of *Theobaldia* (Dobrotworsky, 1954).

Distribution: *A. stigmaticus* Skuse is distributed in Victoria and New South Wales at higher altitudes. In Tasmania two larvae were collected near Hobart. A total of 50♂♂ and 60♀♀ have been examined from the following localities: Tasmania: Hobart



Text-fig. 2.—*Anopheles pseudostigmaticus*, n.sp. Male terminalia, a, tergal view of right part; b, harpago; c, phallosome; larva, d, dorsal view of head; e, pro-, meso- and metathoracic pleural setae; f, leaflet from seta 1 abdominal segment IV; g, pecten; h, median plate of scoop; i, pupa, dorsal view of terminal abdominal segments.

(1.vi.48, E. G. Connah); Victoria: Lorne (3.x., 31.x.55; 28.iii.56), Maroondah (xi.54; iii, vii, ix.55; i, iii, iv.56); Woods Point (23.ii.55) all collected by N. Dobrotworsky, Tarra Valley (15.xii.55, T. Pearce); New South Wales: Merricumbene (1.6.55, A. Dyce), Colo Vale (26.4.54, D. Lee).

ANOPHELES PSEUDOSTIGMATICUS, n. sp.

Types: The type series were bred from larvae collected at Maroondah, 26.6.56. All specimens have their associated larval and pupal skins. The holotype male, allotype female, six male and six female paratypes are in the collections of the National Museum, Melbourne. One male and one female paratypes are in each of the following collections: C.S.I.R.O. Division of Entomology, Canberra; School of Public Health and Tropical Medicine and Macleay Museum, Sydney; University of Queensland, Brisbane; British Museum (Natural History), London, and U.S. National Museum, Washington.

Distinctive Characters: Adult with basal 0.7–0.8 of hind femur pale. A single upper sternopleural bristle. Knob of haltere pale scaled. Abdomen uniformly brown, segment VIII usually paler. Ventral lobe of harpago with three setae (Text-fig. 2, *b*). Phallosome with about 12–15 pairs of straight leaflets (Text-fig. 2, *c*). Larva brown. Antennal seta 4 2-branched. Pro- and metathoracic seta 9 2–3-branched (Text-fig. 2, *e*). Valve seta 13 very long (Text-fig. 2, *h*). Pecten with 23–27 spines (Text-fig. 2, *g*).

Adult.—Male. Head: Vertex with very long, narrow, pale-golden upright forked scales. Frontal tuft pale-golden; ocular bristles black; vertical pale-golden. Tori dark brown; two apical flagellar segments of antenna brown, others pale. Vertical hairs long, pale. Palps slightly longer than proboscis (excluding labella), two apical segments swollen. Proboscis black scaled, 1.3–1.5 times length of fore-femur, 1.0–1.3 times length of fore-tibia. Thorax: Scutum brown, fossae and scutellum paler. Anterior pronotum, part of posterior pronotum, patch on postspiracular area, subspiracular area and meson all dark. Scutum with numerous golden acrostichal and dorso-central bristles; bristles above wing roots and scutellar bristles dark. Anterior pronotum with golden bristles; propleuron with a single bristle; 1 spiracular, 1 strong upper and 1–3 weak lower sternopleural bristles; 1–3 prealar and 2–3 upper mesepimeral bristles.

Legs: Fore- and mid-femora and tibia dark scaled above, pale below; basal 0.7–0.8 of hind femur entirely pale scaled, remainder dark. Tarsi dark scaled.

Wings: A slight darkening of the wing membrane covers tip of *Sc* and base of M_{3+4} . Cell R_2 about equal to length of its stem. Halteres pale, knob pale scaled. Wing length 3.2–3.4 mm. Abdomen: Dark brown, except for paler VIII segment. Terminalia (Text-fig. 2, *a*): coxite short, blunt tapering, about twice as long as broad, with long setae laterally and sternally; strong subapical spine on the inside; a stout parbasal spine on elongate base. Style slightly longer than coxite, widened at both ends, with 8–12 fine setae along its inner side and 2–4 at apex; terminal appendage small. Ventral lobe of harpago with three setae; two close together near the tip, third distant from the first two. Dorsal lobe with four setae in a close-set row and a stronger fifth seta distally between the row and ventral lobe. Phallosome with about 12–15 pairs of long, straight, slender, smooth leaflets. Lobes of IX tergite widely separated, convex, with numerous short setae.

Female: This differs from male as follows: Segments of antenna dark, almost black, except base of first which is pale; vertical hairs black. Palps black scaled, as long as proboscis (excluding labella); fourth segment about twice as long as fifth. Proboscis black scaled, about equal in length to fore femur and 0.7–0.8 length of fore tibia. Labella dark brown. Thorax: 1–3 lower and 1 upper sternopleural bristle; 1–4 prealar and 3–5 upper mesepimeral bristles. Cell R_2 1.1–1.2 times as long as its stem. Wing length 3.3–4.0 mm.

Pupa: Trumpet broad, triangular. Abdomen (Text-fig. 2, *i*): Segment VI: seta 1 5–10-branched, about half length of segment, shorter than 5; seta 2 3–7-branched; seta 3 2–3-branched, slightly shorter than 5; seta 4 3–4-branched; seta 5 stout, plumose, half length of segment; seta 6 long, 3–4-branched; seta 7 a stout spine. Segment VII: seta 1 4–9-branched; seta 2 3–6-branched; seta 3 2–6-branched; seta 4 single or 3-branched; seta 5 plumose, three-quarters length of segment; seta 6 fine, 2-branched; seta 7 a spine. Segment VIII: seta 5 fine, single or 2–6-branched; seta 7 plumose. Paddle with fringe; seta 1 single, stout; seta 2 small; fine tuft, 4–5-branched.

Larva: Usually uniformly brown, sometimes with trace of blackish longitudinal stripe dorsally. Head (Text-fig. 2, *d*) light brown with dark spots and median longi-

tudinal stripe. Setae 2 close set, long, single, simple, often crossed; seta 3 single, simple, shorter than 2; seta 4 single, simple, shorter than 3; setae 5, 6 and 7 plumose; seta 8 single or 2-branched; seta 9 2-4-branched. Antenna with fine spicules all over surface; seta 1 short, 2-4-branched; seta 4 2-branched. Thorax: Prothoracic seta 1 8-12-branched; seta 2 11-14-branched; seta 3 single, short (about half length of that in *A. stigmaticus*); seta 9 2-3-branched, setae 10, 12 long, single, simple; seta 11 short, single. Mesothoracic setae 9 and 10 very long, single, simple; seta 11 very short, single; seta 12 2-3-branched. Metathorax with small transverse medial plate. Seta 1 palmate with about 15-17 slender leaflets; seta 9 2-3-branched; seta 10 single, long; seta 12 short, 2-4-branched. Abdomen: Segments I-VII with narrow transverse tergal plate; behind this on segments I-VII a pair of small plates; segments III-VII sometimes with a small median plate behind large one; on segment VIII, tergal plate almost covering dorsal side of segment. Leaflets of palmate seta with toothed edges distally (Text-fig. 2, *f*). Pecten with 23-27 spines. Median plate of scoop broadening posteriorly; seta 13 single, as long as width of plate where it arises. Saddle covered with fine spicules; saddle hair long, single, simple. Outer hairs of dorsal brush with 5 long and 3-5 short branches; inner hair plumose; ventral brush of 15-16 plumose hairs. Papilla about half as long as saddle.

Biology: It is a homodynamous species. No adults have been taken biting. The larvae have been collected only in two localities in Victoria; at Maroondah in the grassy edges of a swamp, with clean water and in ground pools, and at Baxter during the early spring, when the larvae were found in the slowly running shallow water in a grassy ditch at the side of a country road. At Merricumbene, New South Wales, Mr. A. Dyce has collected larvae all the year round. They occur in rock pools, weedy ground pools near the river margin and in seepage or overflow pools with clear or slightly muddy water. The breeding places may be shaded by trees or exposed to the sun; in the latter case, the larvae are most numerous among marginal grasses or in the shade provided by an occasional log. The larvae of *A. pseudostigmaticus* have been found in association with *A. annulipes* Walk., *Aë. queenslandis* Str., *T. inconspicua* Lee, *C. fergusonii* Taylor, and in a few cases during the winter-spring with *A. stigmaticus* Skuse. In New South Wales they are also associated with *Aë. alboannulatus* Mag., *C. cylindricus* Theo. and *C. pseudomelanoconia* Theo.

Distribution: It is distributed in eastern Australia from Victoria to southern Queensland ("southern brown form", E. Marks, 1956). A total of 50 ♂♂ and 90 ♀♀ have been examined from the following localities: Victoria: Maroondah xi.54, ix.55, i, iii, vi.56; Baxter 19.vii.56 (N. Dobrotorsky); New South Wales: Merricumbene, xi, x.54; i, iii, v, vi, viii, ix, xi.55; iv.56 (A. L. Dyce), Castle Hill, Waterfall; Colo Vale 26.4.54 (D. Lee); Colo Vale 26.10.54 (A. O'Gower); National Park (I. M. Mackerras).

ANOPHELES PAPUENSIS, n. sp.

Types: The type series were bred (4.8-8.10.56) from larvae collected at Minj, New Guinea (S. H. Christian). All have their associated larval and pupal skins. The holotype male, allotype female and six male and six female paratypes are in the collection of Division of Entomology, C.S.I.R.O., Canberra. One male and one female paratype in each of the following collections: School of Public Health and Tropical Medicine, Sydney; Macleay Museum, Sydney; University of Queensland, Brisbane; The National Museum, Melbourne; British Museum (Natural History), London; and U.S. National Museum, Washington.

Distinctive Characters: Adult with 0.7-0.8 of hind femur pale. One upper sternopleural bristle. Knob of haltere dark scaled. Abdomen brown, VIII segment paler. Ventral lobe of harpago with three setae (Text-fig. 3, *b*). Phallosome with 8-10 pairs of straight leaflets. Paddle of pupa elongate, twice as long as broad. Larva dark, abdominal segments IV and V pale. Head seta 5 much longer than setae 6 and 7 (Text-fig. 2, *c*). Prothoracic seta 9 long, 4-8-branched. Metathoracic seta 9 4-8-branched (Text-fig. 3, *e*). Valve seta 13 about as long as half the width of the plate where attached (Text-fig. 3, *h*).

Adult: Male: Head: Vertex with long, narrow, pale-golden upright, forked scales. Frontal tuft pale-golden, ocular bristles black, vertical pale-golden. Tori dark brown; two apical flagellar segments of antennae brown, others pale; vertical hairs long,



Text-fig. 3.—*Anopheles papuensis*, n. sp. Male terminalia, a, tergal view of right part; b, harpago; larva, c, dorsal view of head; d, prothoracic setae 1-3; e, pro-, meso- and meta-thoracic pleural setae; f, leaflets from seta 1 abdominal segment IV; g, pecten; h, median plate of scoop; i, pupa, dorsal view of terminal abdominal segments.

pale. Palps slightly longer than proboscis (excluding labella); two apical segments swollen, dark scaled with violet reflections. Proboscis black scaled, about 1.5 times length of fore-femur, 1.1 times length of fore-tibia; labella light brown. Thorax: Scutum

pale; blackish area between dorsocentral bristles and bare prescutal space; two lateral broad, blackish stripes extending from scutal angle along supra-alar area. Metapostnotum blackish. Anterior pronotum, post-spiracular area, lower and upper part of sternopleuron and meson all dark. Scutum with short golden bristles. Anterior pronotum with golden bristles; propleuron with single bristle; 1-2 pale spiracular, 1 strong, long upper and 2-3 short lower sternopleural, 2-3 prealar and 3-5 upper mesepimeral bristles. Legs: Fore- and mid-femora dark scaled except for pale stripe postero-ventrally, not reaching apex; basal 0.7 of hind-femur entirely pale scaled, remainder dark. Tibiae and tarsi dark scaled. Wings: clear, dark scaled, except extreme base, which is pale scaled. Cell R_2 about 1.1 times length of its stem. Haltere with pale stem and dark scaled knob. Wing length: 3.3-3.6 mm. Abdomen: I-VII tergites very dark, VIII pale with large dark median patch. Sternites I-V dark, VI-VIII pale. Terminalia (Text-fig. 3, *a*): Coxite short, blunt, tapering about twice as long as broad, with long setae laterally and sternally; stout subapical seta and stout parabasal spine on elongate base. Style longer than coxite, slightly widened at both ends, with about 10 fine setae on its inner side and 3-4 at tip. Terminal appendage small. Ventral lobe of harpago with three setae; dorsal lobe with four setae in a close-set row and a stout fifth distally between row and ventral lobe. Phallosome with 8-10 pairs of straight, long, slender, smooth leaflets.

Female: This differs from male as follows: Segments of antenna dark, almost black; vertical hairs black. Palps black scaled, slightly longer than proboscis (excluding labella); fourth segment about 1.8-2.0 times as long as the fifth. Proboscis equal to fore-femur and about 0.8 of fore-tibia. Propleuron usually with one bristle, but one specimen has four bristles. Usually one upper sternopleural and four-seven mesepimeral bristles. Wing length: 3.5-3.6 mm., cell R_2 about 1.3 times the length of its stem.

Pupa: Trumpet broad, triangular. Segment VI (Text-fig. 3, *i*): seta 1 4-5-branched, slightly longer than 5; seta 2 fine, small, 6-branched; seta 3 fine, 2-branched; seta 4 fine, 3-4-branched; seta 5 strong, plumose, half length of segment; seta 6 fine, 2-branched; seta 7 a stout spine, half length of segment. Segment VIII: seta 5 fine, 2-3-branched; seta 7 plumose with thickened shaft. Paddle elongate, twice as long as broad; fringe short; seta 1 stout, single; seta 2 fine, small, 2-5-branched.

Larva: Body dark, pro- and mesothorax pale, segment V only slightly pigmented dorsally, IV pale dorsally. Head (Text-fig. 3, *c*) with dark spots; setae 2 arising close together, long, stout, single and simple; seta 3 stout, single, simple; seta 4 fine, single, simple, about three-quarters length of 3; setae 5, 6 and 7 plumose; seta 5 the longest, setae 6 and 7 about $\frac{2}{3}$ - $\frac{3}{4}$ length of 5; seta 8 small, single- or 2-branched; seta 9 larger, 3-branched. Antenna with fine spicules along inner side, becoming denser and larger near seta 1; seta 1 arising near base of antenna, short, fine, with 2-3 branches; seta 4 single. Thorax (Text-fig. 3, *d* and *e*): Prothoracic seta 1 strong, 7-12-branched; seta 2 arising from a sclerotized base, 12-14-branched; seta 3 single; seta 9 long, 4-8-branched; seta 10 and 12 single, long; seta 11 single, short. Mesothoracic setae 9 and 10 long, single, simple; seta 11 very short, single; seta 12 moderately short, 3-branched. Metathorax with small, transverse median plate dorsally. Seta 1 palmate with 12-16 slender leaflets; setae 9 and 10 long, seta 9 4-8-branched; seta 10 single; seta 12 very small, 2-3-branched.

Abdomen: Segments I-VII with narrow transverse tergal plate; behind this on II-VII, or III-VII a single small elongate plate. Segment VIII with large broad plate almost covering dorsal surface of segment. Seta 1 on segments II-VII palmate, almost black, with about 20-25 leaflets (Text-fig. 3, *f*). Pecten with about 20 spines (Text-fig. 3, *g*). Saddle with fine spicules; seta 1 single, simple, long; ventral brush of 16 plumose hairs. Anal papillae almost twice length of saddle. Seta 13 as long as half width of plate where attached.

Biology: The larvae have been collected in mountainous areas at altitudes of approximately 6,000 feet in two localities: at Minj in semi-rock pool covered by *pit pit*, a kind of swamp cane, and at Al Valey in a clear pool 6-8 inches deep, beside a stream shaded by overhanging trees; the water surface was partly covered with

watercress and fallen sticks. There were no other mosquito larvae in the first breeding place; in the second *Culex solitarius* B.-Wepst. was breeding in the same pool.

Distribution: New Guinea: Minj 4.8-8.10.56 (S. H. Christian); Al Valey, behind Nandugl, Central Highlands 25.8.56 (T. E. Woodward).

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