A REMARKABLE MOSQUITO, *OPIFEX FUSCUS*, HUTTON.

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When carrying out an investigation into the mosquitos of New Zealand,* the writer found that a very common species bred in saline and semi-saline pools above high water mark along the rocky parts of the North Island coast line. For some time it was considered that this mosquito was unrecorded, but it appears that Hutton described it as a Tipulid under the name *Opifex fuscus*.† This was pointed out to me both by Mr. G. V. Hudson, of Wellington, who is in possession of Hutton's Tipulid types and had seen the illustrations here reproduced, and later on by Mr. F. W. Edwards, of the British Museum, who published a short account of the insect from material recently sent to him by Mr. Hudson.‡

So remarkable are the adult and pre-adult characters of this mosquito, that the writer considers there are sufficient grounds for the erection of a new sub-family for its reception. The following is an account of the adult and pre-adult stages with a revised outline of the generic characters.

Subfamily OPIFICINAE, nov.

Scales of the head and scutellum flat ; male antennae not plumose ; male palpi not quite as long as the proboscis, those of the female short ; proboscis slightly recurved ; scutellum trilobed ; cell R_2 of wing slightly longer than cell M_2.

This subfamily is apparently near the MEGARHININAE of Theobald, which it resembles in the flat scales of the head and scutellum ; the slightly recurved proboscis also approaches the strongly recurved form characteristic of that subfamily, to one genus of which also (*Toxorhynchites*) the short palpi of the female bear some resemblance. The relative lengths of cells R_2 and M_2, however, together with the character of the male antennae exclude this species from the MEGARHININAE.

Genus **Opifex,** Hutton.

Antennae of male not plumose, the third, fourth and fifth joints each with a distinct dorsal spine arising from a pronounced basal swelling. Palpi of male clubbed at the apex, about two-thirds the length of the proboscis, which is slightly curved backwards ; neither proboscis nor palpi conspicuously haired. Antennae of female without the three spines present in the male ; palpi very short. Clypeus globular. Occiput clothed with flat scales. Legs of female normal, the front pair of the male short and stout, their claws simple but very long. Scutellum trilobed, clothed with flat scales and long bristles ; metanotum bare. Wings with base of cell R_2 somewhat anterior to that of cell M_2, the former a little longer than the latter ; cross-vein r–m anterior to origin of vein R_{4+5} ; cross-vein m–cu a little more than its own length posterior to cross-vein r–m.

Opifex fuscus, Hutton.

♂. General colour blackish. Occiput cinereous, with a pronounced median fissure extending from the vertex to a prominence above the foramen ; uniformly clothed, except in the fissure, with white flat scales (fig. 1, *a*) ; bristles of posterior

* Miller, D., "Report on the Mosquito Investigation," pt. 1, N. Z. Dept. of Health Bull., no. 3 (1920).

† Hutton, F. W., Trans. N. Z. Inst., xxxiv, p. 188 (1902).

‡ Edwards, F. W., Bull. Ent. Res., xii, p. 73 (1921).

orbits large and black ; eyes blue-black. Antennae (fig. 1) black, with a vestiture of minute greyish hairs ; not plumose, 14-jointed, the joints for the most part narrow and not swollen ; second joint bristly ; third, fourth and fifth with a dorsal row of

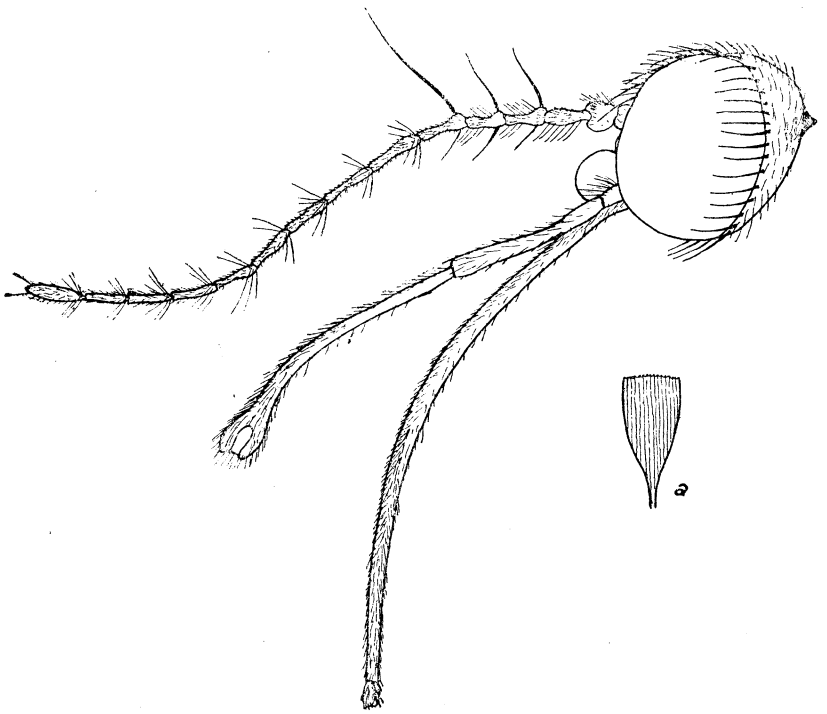

Fig. 1. Head of *Opifex fuscus*, Hutton, ♂ ; *a*, an occipital scale, enlarged.

bristle-like hairs and a basal and apical whorl of bristles, the apical ones more delicate and hair-like ; each of these three joints with a prominent dorsal swelling basally, from each of which arises a strong elongate spine, that of the fifth joint being nearly

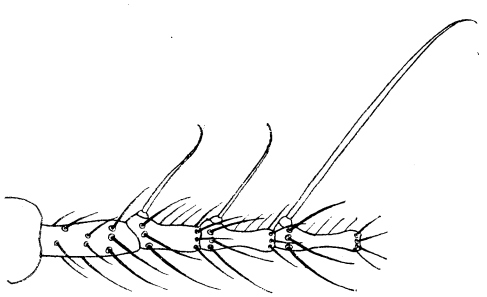

Fig. 2. Basal antennal joints of ♂.

three times as long as either of the other two (fig. 2) ; each spine appears to arise from a swelling giving the appearance of a short joint ; joints 6–14 with a basal whorl of bristle-like hairs ; apical joint elongate-oval terminating in two short hairs.

Palpi black, about two-thirds the length of the proboscis (fig. 1), clubbed at the apex, 3-jointed, with a vestiture of short, delicate greyish hairs ; first joint short and distinctly bristly ; second elongate, but not half the length of the whole ; third joint

elongated, swollen at the apex, about half the length of the whole, the apex truncated and with some bristle-like hairs and a cup-shaped depression apparently leading into an elongate glandular sac. Surface of the third joint, except for the apical knob, transversely striated by trachea-like ridges giving a serrated appearance in outline ; under a high power the ridges are seen to carry minute bristles and are not continuous but broken ; on the second joint the ridges are diagonally arranged distally, but disappear proximally, where the minute bristles are irregularly arranged ; there are no ridges on the basal joint.

Proboscis longer than the palpi (fig. 1), curved slightly backward in nearly all specimens ; black in colour and clothed with white flat scales and short greyish hairs. Labrum-epipharynx (fig. 3, 3 *a*) strongly developed. Clypeus globular, black in colour but with greyish reflections.

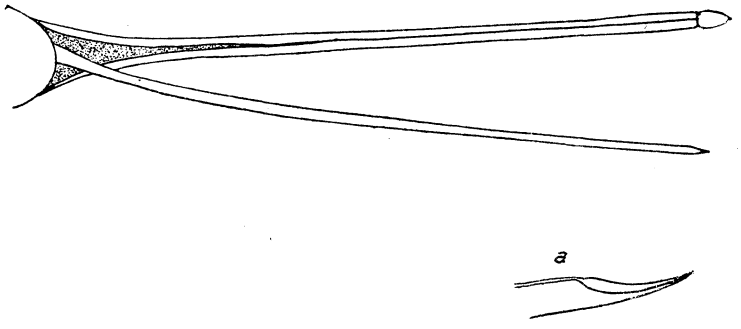

Fig. 3. Labrum-hypopharynx of ♂ ; *a*, apex of hypopharynx.

Thorax and scutellum black with cinereous reflections ; dorsum sparsely clothed with golden and black spindle-shaped scales and rows of black bristles ; scutellum trilobed, clothed with white flat scales and strong black bristles from each lobe ; pleurae cinereous, clothed with white flat scales ; ptero-pleurae with a tuft of golden hair-like bristles above and larger black bristles below ; mesopleurae with black bristles below ; metanotum nude, blackish brown with cinereous reflections.

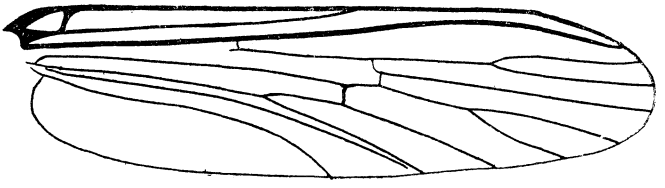

Fig. 4. Wing of *Opifex fuscus*.

Wings (fig. 4) translucent, without markings, apex blunt ; base of cell R_2 somewhat anterior to that of cell M_2, the former a little longer than the latter, which however is distinctly wider ; cross-vein r–m anterior to origin of vein R_{4+5}, which is geniculated ; cross-vein m–cu a little more than its own length posterior to cross-vein r–m ; veins purple to blackish brown ; the scales long and linear, among which are shorter and rather broader ones. Halteres with black globular heads and white flat scales, the stalks yellow to golden.

Anterior legs (fig. 5) stout and very much shorter than the others ; brownish black, clothed with short closely-set black bristles and flat greyish scales, becoming white on proximal part of the femora, which have a proximal row of three black bristles on upper lateral surface ; the tibiae shorter than the femora and distinctly widened ; tarsal joints swollen apically, the pro-tarsus about half the length of the whole, the following joints shortening consecutively, the onychotarsus being very short ; claws

simple, extremely long, being about one-third the length of the tarsus. Middle and posterior legs slender, the former the longer ; both deep purplish-blue with a lighter brown reflection and clothed with white scales and distinct scattered bristles ;

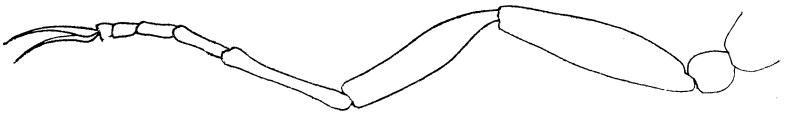

Fig. 5. Anterior leg of ♂.

a row of widely separated bristles distally on anterior side of the femora ; the tibiae —the posterior pair being slightly swollen apically—with a row of bristles on the posterior side and another more dorsally ; tarsi with a dorsal row of bristles ; claws simple and normal. All the femora and tibiae white at the apex.

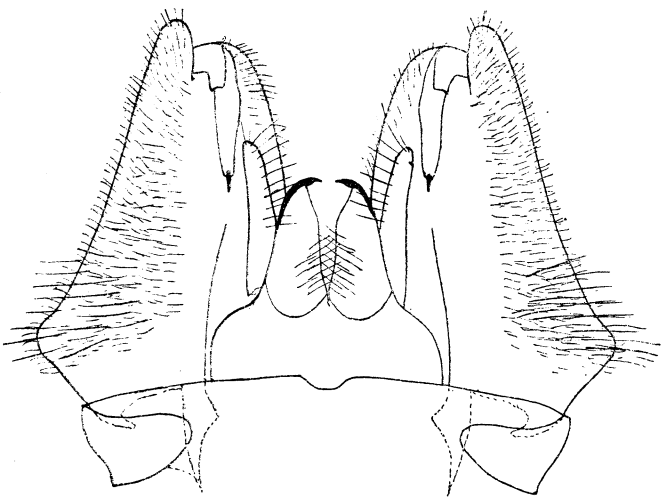

Fig. 6. Male genitalia of *Opifex fuscus*.

Abdomen shiny brownish black, clothed with short black bristles and white flat scales, the latter arranged as triangular spots at the anterior angles of each segment. Genitalia prominent, their structure shown in fig. 6.

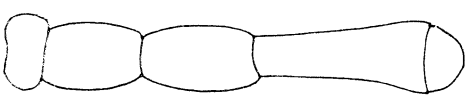

Fig. 7. Palpus of ♀.

♀. Palpi (fig. 7) about one-fourth the length of the proboscis, 4-jointed, with a stricture near apex of fourth joint ; swollen apically, black, clothed with white scales and black bristles. The maxillae (figs. 8, 9) strongly serrated at the tip, the " feathery corrugations " referred to by Dimock being readily seen on the transparent " shaft of the maxilla." In *O. fuscus*, however, the " chitin-rod " apparently

Fig. 8. Maxilla of ♀.

lies along the centre of the shaft, the two sides of which lie in a **V**-shaped position, forming a partial tube with the rod running along the fork of the fold. Antennae

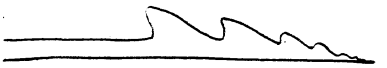

Fig. 9. Apex of maxilla of ♀.

14-jointed, with no spines as in the ♂ but each joint with a whorl of sparsely set, bristle-like hairs longer on proximal joints. Front legs and claws normal. Colour as in the ♂, but the scales golden at times, and the body a deep purplish-blue in some

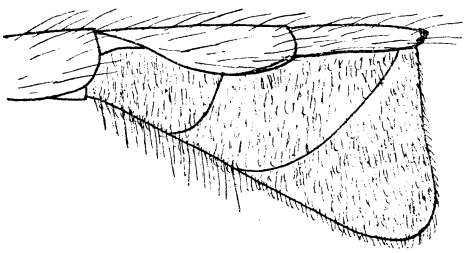

Fig. 10. Apex of abdomen of ♀ as it appears in a dried specimen.

lights. Apical sternites of abdomen swollen and descending in dried specimens (fig. 10), but normal and evenly rounded with the rest of the abdominal sternites in the living insect.

Length of ♂ and ♀, 5 mm.

Larva.

Larva blackish brown or sometimes greenish in colour, the segments well defined. Siphon short, twice as long as broad, with a pair of branched hair-tufts ventrally a little above the middle (fig. 11) ; siphonal pecten consisting of three short bristles

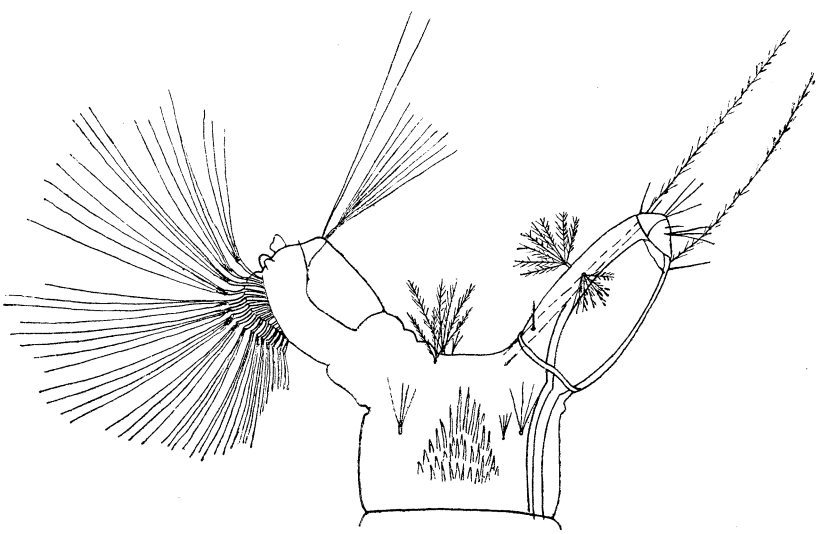

Fig. 11. Siphon and apical abdominal segments of larva of *Opifex fuscus*.

(fig. 12), on the opposite side to which, near the base of the siphon, is a single spine (fig. 11). Orifice of siphon closed externally by a pair of cup-shaped valves, from each of which arises a tuft and a single hair ; on the siphon near the orifice is a bristle-like hair and two very long and delicate branched ones ; internally the two tracheae

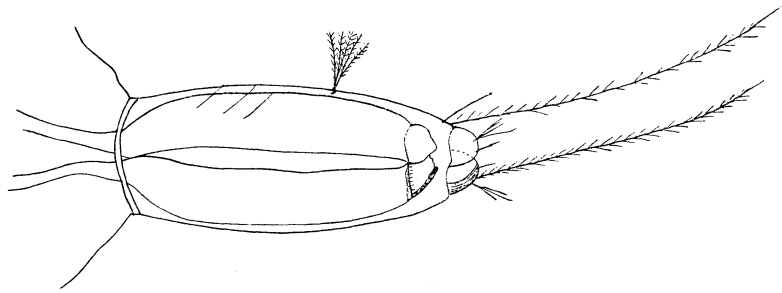

Fig. 12. Siphon of larva.

do not reach the external valves, each tracheal opening being protected by a cup-shaped valve, one being opposed to the other, so that when drawn together their rims meet and completely close the tracheae (fig. 12). Along the lower inner edge of each valve where attached to the trachea is a ridge bearing numerous short and delicate hairs (fig. 13).

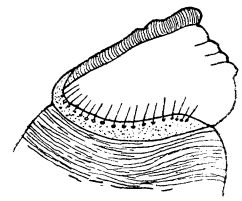

Fig. 13. An internal tracheal valve of larva.

Anal plate confined to the distal two-thirds of the anal segment and extending on each side to the median line (fig. 11) ; an inconspicuous bristle arises from anal plate on one side. Hair-tufts on dorsal angle of anal segment consisting of a pair of long straight hairs and a single tuft of somewhat shorter ones. Anal gills absent and represented by three short tubercles capable of being retracted (fig. 11). Ventral fringe well developed, consisting of several tufts of very long hairs.

Comb of eighth segment triangular, the spines strong and stout, those at the apex large and conspicuous but very short at the base ; the vestiture of this segment as in accompanying diagram (fig. 11).

Head pendulous, transversely ovate from above, narrower than the thorax, opaque ; mouth-brushes golden. Antennae apparently single-jointed, bare, except for the short terminal hairs (fig. 14). Clypeus slightly sinuated and armed with a pair of straight spines. Labrum cuneiform, its apex extending beyond the chitinous processes of the mouth-brushes ; its surface clothed with bristle-like hairs, while near its base in front of the clypeus is a small hair-tuft ; at the apex dorsally is a

clavate yellow structure clothed with hairs and with a darker central spot at its apex (fig. 14). Vestiture also shown in figure.

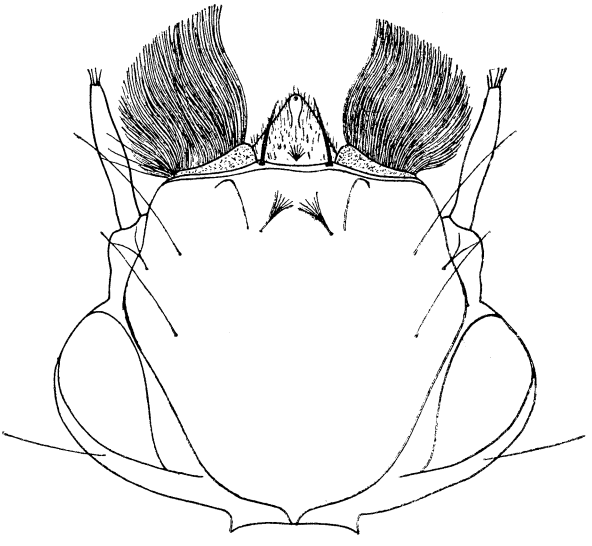

Fig. 14. Head of larva, dorsal aspect.

Mandibles (fig. 15) roughly rectangular, the articular surface broad, the sides converging and triangular in transverse median section: a single elongate spine on angle of outer ridge; a large claw-like and toothed appendage attached near the

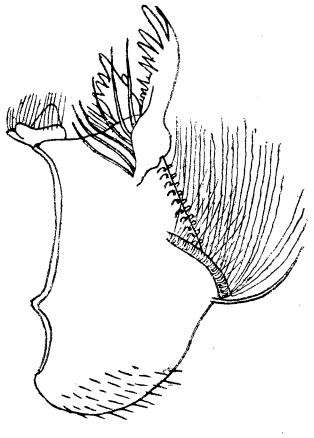

Fig. 15. Mandible of larva.

outer molar angle, and from the base of the claw arise several bristle-like hairs; this appendage is apparently freely movable; on the outer molar angle is also a short toothed* appendage, while at the inner angle is a bifid hairy projection. Along one

* These appendages, in variable form, are present on the mandibles of other New Zealand mosquito larvae. They resemble to a great extent the appendages on the mandible of *Campodea* as figured by Packard in his Text-book of Entomology, p. 60, fig. 48; the movable claw resembling his prostheca, or lacinia, and the others his galea. In some other species there is a pair of elongate spines on the angle of the outer ridge agreeing with the observations of other authors.

side of the outer edge is a row of minute and strongly recurved spines, while opposite and parallel to these is a row of delicate hairs, each inserted in a small tubercle. Extending from the spine on the upper angle on to the side of the mandible is a broad ridge bearing numerous long hairs. The lower side consists of two ridges, upon each of which is a condyle for the attachment of the mandible to the cranium.

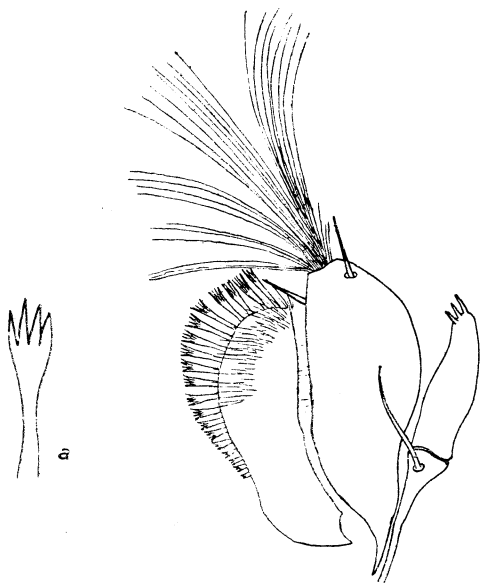

Fig. 16. Maxilla of larva, dorsal aspect ; *a*, forked hair.

Maxillae (fig. 16) brownish, each, as a whole, roughly ovate but separated into two parts, apparently representing the galea and lacinia, by a median fissure extending from the apex to the base, while on the outside of the galea is a well-developed two-jointed palpus. The lacinia is shorter than the galea, and along its outer margin and upon the anterior part of the dorsal surface are numerous flat forked bristles (fig. 16, 16 *a*), which become short posteriorly and do not extend to the articulation ; ventrally from the apex and almost to the articulation runs a ridge from which arise numerous long golden hairs directed outwards. The galea is shaped like the lacinia, but is truncated apically to carry a dense plume of golden brown hairs, which are as long as the whole maxilla ; on each side just below the apex is a stout spine, the dorsal one arising near the outer margin and the ventral near the inner (fig. 16). Ventrally runs an indistinct ridge, near the inner margin, extending from the apex to the articulation and between this ridge and the inner margin arise innumerable golden hairs ; towards the apex the surface is clothed with long delicate hairs. The palpus is two-jointed, the terminal joint being elongate and evenly rounded, though somewhat narrower apically and terminated by three short blunt teeth ; the basal joint is clavate and elongate, tapering to the articulation, while dorsally near its anterior margin arises a long sinuated spine (fig. 16). Ventrally towards the base of the apical joint are numerous delicate hairs. At the articulation the lacinia is produced to a point and the galea evenly rounded. The galea, lacinia and palpus of each maxilla are united by a basal membrane, a continuation of which also attaches

them to the base of a triangular chitinous plate inserted between the cranium and the gular region ; on this plate near the attachment of the galea is a stout spine (fig. 17).

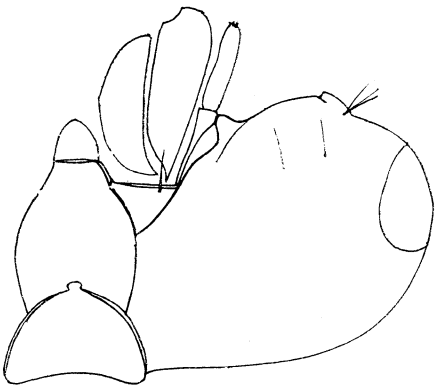

Fig. 17. One side of head of larva, ventral aspect, showing attachment of maxilla.

The vestiture of the ventral surface of the cranium is shewn in this diagram. Labium (fig. 18) triangular, its margin serrated.

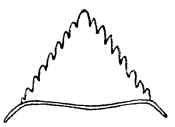

Fig. 18. Labium of larva.

Thorax much broader than the head, broadly ovate, produced on each side ; on the dorsum are two transverse sutures not extending to each side. The vestiture arranged as shown in accompanying diagrams (fig. 19).

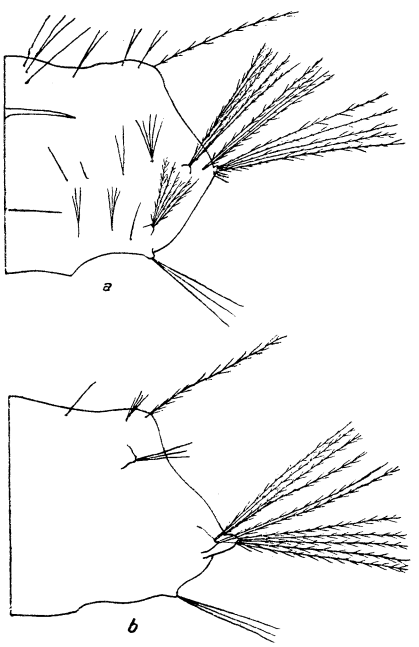

Fig. 19. One side of thorax of larva ; *a*, dorsal aspect ; *b*, ventral aspect.

The abdominal segments slightly produced laterally, except the seventh ; the lateral hair tufts longer on the anterior segments.

Length of full-grown larva 12·5 mm.

Pupa.

Thorax with a distinct, pale brown, medio-longitudinal keel-like ridge, divided into an anterior and posterior section by a lower and broad transversely corrugated area (figs. 20, 21) ; the anterior part of the ridge is crescentic in profile and arises from

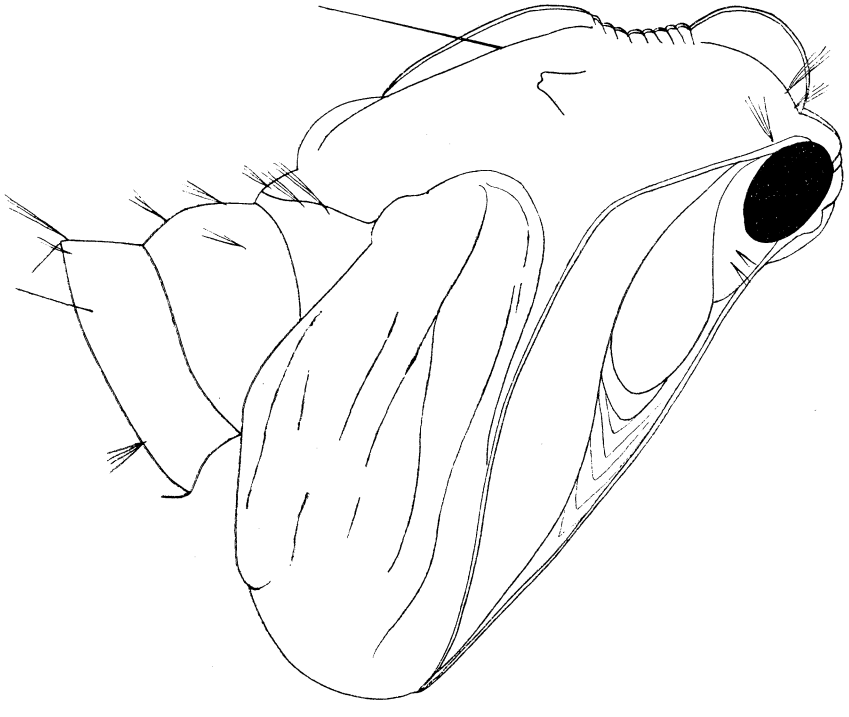

Fig. 20. Thorax of pupa, lateral aspect.

just behind the head, ending posteriorly in the transversely corrugated area, which is lower in the middle but rises at each end, where it joins the anterior and posterior portion of the median ridge. When examined from above, the corrugated area is broader anteriorly and narrows posteriorly where the median ridge arises. The posterior section of the ridge is crescentic but much lower and longer than the anterior, ending some distance before the posterior margin of the thorax ; the edge of both sections of this ridge is supported by a somewhat thickened margin. On each side of the posterior section is a lower one (figs. 21, 22) arising towards the posterior end of the corrugated area and extending almost to the posterior margin of the thorax ; the area enclosed by the two outer ridges is elongate and somewhat bottle-shaped (fig. 21). Each outer ridge is armed with short spine-like hairs along the inner side,

while more anteriorly than centrally there is a very long and straight bristle. Between these ridges and the median keel is a distinct depression. Vestiture as shown in

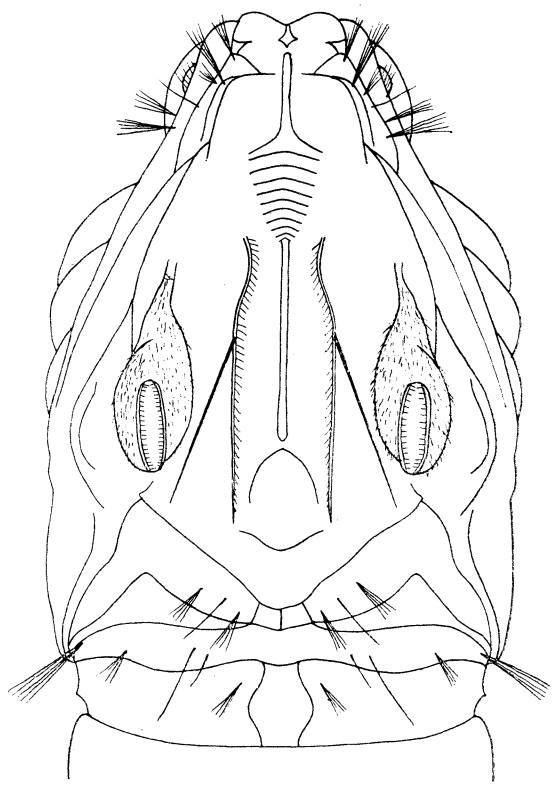

Fig. 21. Thorax of pupa, dorsal aspect.

diagram (fig. 21). Respiratory appendages situated slightly anterior to middle of the thorax, squamous, with short spines on the dorsal surface (fig. 23) ; the orifice

Fig. 22. Transverse section through dorsum of pupa, showing central keel and lateral ridges.

(fig. 21), when open, elongate-oval, with long delicate hairs within and short hooked bristle-like hairs along the margin.

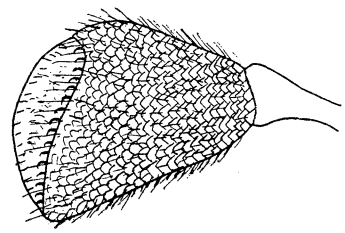

Fig. 23. Respiratory appendage of pupa.

The abdominal segments well defined. A pair of long dorsal spines, one on each side, towards the posterior margin of segments 1–6. Anal plates (fig. 24) more or

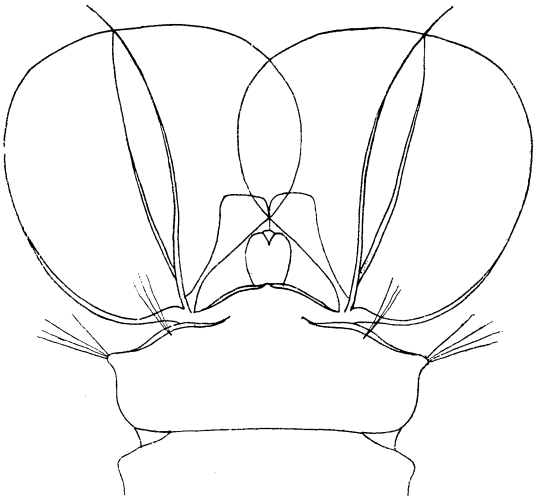

Fig. 24. Anal plates of pupa.

less circular and rather bladder-like, a conspicuous ridge supporting the outer edge of each basally ; the central transverse ridge, running dorsally and ventrally, terminates in a short bristle ; anal segment truncated.

Habits.

Opifex fuscus is restricted to the rocky coast line and breeds in the semi-saline pools containing water left by high tides. The winter is passed as larvae and pupae, considerable numbers of the adults emerging in the early spring.

The larvae are carnivorous and cannibalistic, but also " browse " amongst the sand and accumulations on the bottom of the pools ; they are able to remain submerged for lengthy periods when feeding, and occasionally come to the surface where they remain for a moment before returning to the bottom of the pool, although at other times they hang suspended from or beneath the surface. Masses of the pupae and larvae are often to be seen resting, suspended and practically motionless for long periods, well beneath the surface of the water. Large quantities of sand pass through the intestines and are voided as cylindrical pellets. The larvae will be frequently noticed to double up and draw the hairs of the anal segment through the mouth appendages or clean the orifice of the siphon. They also comb out the mouth-brushes on the comb of the eighth segment. The pupae in swimming propel themselves forward by a backward flip of the caudal appendages, at the same time turning the dorsum of the thorax over in the direction in which they desire to go.

Large numbers of the adults rest on the surface of the pools, over which they are capable of moving with considerable rapidity, aided by the small hairs along the underside of the tarsi. The whole tarsus is not applied to the water, the apical joints being held upwards from the surface. The mosquito is readily able to rise on the wing, but when at rest on the water the body is carried at a slope posteriorly, the head being in a slightly higher plane than the apex of the abdomen, while the proboscis projects forward parallel to the water-surface.

Professor H. B. Kirk, of Victoria College, Wellington, who is preparing an account of the habits of this mosquito, finds that the eggs are black and laid singly upon the rocks, against which they are inconspicuous on account of their colour.