

NOTES ON A SPECIES OF SANDFLY.

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THE sandfly is a popular term, which includes members of different species of Diptera.

The subject of the present paper is found in Brisbane, and seems to be related to a species named "*Ceratopogon Albo-punctus*." These insects are exceedingly troublesome both to man and animals. Being so minute, the ordinary mosquito netting is no barrier to its progress. A hole of a fiftieth of an inch in diameter is only a narrow way leading to her heaven if she is hungry and you are inside. Unlike her compeer, the mosquito, she gives no warning of her approach, but does her spiriting gently, and knows intuitively where the most tender parts of your anatomy lie.

Like all insects, it is naturally divided into three parts, viz., the head, chest, and abdomen. The head resembles a partially compressed globe, the compound eyes occupying nearly the whole of the sides and frontal space, leaving a central aperture, through which the mouth organs project. The cells of the eye do not assume the honeycomb shape of the common house fly, but each is separated from its neighbour by a firm chitinous frame, so that, though there are hundreds of these cells massed together, yet each preserves its circular form.

A pair of beautiful antennæ spring from the sides of the frontal space. These consist of fourteen joints, varying in shape according to their position. The basal one is much enlarged, globular and slightly elongated; to this are articulated

a number of joints resembling pitchers, the base of each being rounded, with a contracted neck, bearing on the lower part a circlet of long curved hairs, projecting outwards. Each hair is inserted into a socket, which, when the hair falls, appears as a white cup-like depression. The first eight of these urn-shaped joints resemble each other, but the last five differ, gradually elongating and growing narrower. The terminal one is like a minie rifle bullet. From the point projects a delicate cone, evidently a sense organ, probably a taste bud.

Between the antennæ, but a little lower are the palpi, a pair of organs consisting of four differently shaped joints, the second peculiarly so, resembling a shoulder of mutton in miniature, and on the fleshy part is a circular pit. In this are a number of truncated cones, bearing little nucleated globes on their ends. I have not seen anything like them delineated anywhere; and it appears to me to be a delicate sensory apparatus, for communicating sound waves, inaudible to the human ear.

Between the palpi there springs the proboscis. It lies in the median line. Externally it consists of a fleshy sheath, terminating in two thick lips or flabella. They are slit on the underside, and by certain muscles can be drawn back so as to expose the lancets contained within.

Like its sanguinary friend, the mosquito, it possesses an armoury of six distinct lancets, but they are much thicker and stronger comparatively. In use, the whole are combined together, forming a stout weapon of offence, not unlike a broadsword. These lancets are paired, so that there are three groups, of like nature. The two outermost are the maxillary lancets; these are attached to the facial plate which carries the palpi. In dissection, the two generally come away together. These are distinguished by their concave scythe-like blades, shaped so as to fit over and clasp the inner lancets. From the point to a space half-way down the organ is a row of large teeth, set like a ripping saw, to enlarge the cut when they are withdrawn. Next are the mandibles, much resembling a couple of carving knives. One edge is thin, the other stouter. The end being broadly lanceolate, one angle being tipped with small regular teeth, like a tenon or surgeon's saw. These are easily recognised by having a longitudinal slit, such as is made in the blade of a pocket knife, for ease of opening.

Still going inwards, the two central lancets of the group are found. These are like a tube with a rounded end, split longitudinally, and placed so as to form a hollow chamber. The

tips are indented deeply, making straight marginal teeth. A fine tube appears to run down the centre to the point. This is probably the channel by which the poison is injected into the wound. These central lancets are prolonged into the mouth, widening into a trumpet-like chamber, which receives the end of the tube connected with the stomach. They are likewise attached laterally by two horny projections to muscles in the head, which seem capable of thrusting these lancets deeper, or withdrawing them from the wound. From the oral surface, the lancets measure one hundredth of an inch in length.

There is a probability that only the female sandfly attacks man. I have never found a male insect upon me. At the Tweed River one afternoon I caught about fifty on my hands, but there was not one male among them. Every specimen was of the feminine gender. So that what is broadly true of the mosquito—that only females attack man—seems to hold good with this little insect too.

The thorax is dark brown, almost bare on the dorsal aspect, with scattered golden hairs on the sides. The parts are welded together so that it forms a concave shield extending from the neck to the abdomen, with a well defined border along the sides. In shape it is not unlike the shell of a tortoise. On the part near the head are two angular apertures for the admission of air—the prothoracic spiracles.

Below the lateral border arise the wings, they are oval, the posterior border being abruptly rounded below the axilla, and densely covered with black hairs. No marginal cross vein is visible, and the only transverse one is in the axilla, where passing above the curve formed by the junction of the roots of the third and fifth longitudinals, it unites the first to the sixth.

The first longitudinal arises from the root of and on a level with the costal. Curving downwards, it runs parallel, and then unites with the costal at a point a little on its side of centre of the wing. Both these veins are very much thickened. A second longitudinal proceeds parallel from the middle of the axillary joint to a point two-thirds of the length of the first, where it turns up abruptly to coalesce with it, forming a thickened rib which terminates in a club-like form on the costal border. Immediately beyond this is a marginal pale U-shaped spot where the hairs are thinly scattered. This is most distinctly visible when examining the insect in a natural state.

The third longitudinal starts a little beyond the point where the second unites with the first, and pursues a straight course to the border of the apex of the wing.

Below this and originating about the centre is the fourth faintly marked longitudinal, pursuing a parallel course but dipping slightly, it reaching the edge as far below the apex as the termination of the third is above it. None of these are forked.

The fifth, arising in the axilla, is very distinct; it runs obliquely until below the thickened insertion of the first veins on the costal edge; on reaching that point it forks, the upper arcuating slightly, the lower tending downwards to unite on the lower border at its central point. The petiole is a little more than the length of the fork. A sixth longitudinal faintly marked runs a little below and parallel with the petiole, near the bifurcation of which it terminates.

The legs are very muscular, and are often used in leaping from one point to another, after the manner of the lively flea. A jump of fifty times their length is no unusual thing. The pro-legs are the shortest, the middle and hind ones not differing much in length. The first long joint is the thigh or femur; the second, rather thinner, is the tibia, or shank; and the tarsus, or foot, is formed from the last five joints.

The first joint of the hind foot is noticeable for a row of spines of equal length placed in one line, like the teeth of a comb. The insect actually puts them to this use. Occasionally it can be seen combing out its hairs on the abdomen, and other parts of the body. And I have seen the gentlemen bending down his head, and with the bristles on his fore legs combing out his whiskers, or the long hairs of his antennae, very likely before he went out to visit his young lady.

The joints of the legs seem to be connected rather loosely together, but this gives them a wide range of movement. Each leg terminates in a pair of claws widely separated like the hooks of a grappling iron. They are black and sharply pointed. Between these hooks a little feathery organ hangs. I have not been able to reproduce it in a photograph, so have made a rough sketch of it. It is like a root with lateral branches. The shaft and branches are dotted with little cells. No doubt it is the representative of the pulvilli of the housefly. The minute dots are cells secreting glutinous material, which enable it to adhere to smooth surfaces, where the claws cannot obtain a foothold. On the tibia of the female are a few small cones, or club-like

hairs, seemingly connected with some special sense. Most likely they are olfactory cones, or organs of smell. Insects often have sense organs in what are to us unlikely places. For instance, the locust has an ear on the leg. And it is not improbable that they have senses differing from any that we possess.

The abdomen is composed of the usual chitinous segments found in insects. The dorsal aspect is of a dark brown colour, with a narrow grey bar separating the segments, which also extends like a stripe along the sides. This lighter portion is capable of considerable expansion, when the eggs are enlarged in the ovaries. Long curved hairs, black in colour, are scattered over the parts, being longer in the male body. In his case the last segment terminates in a pair of hooks called claspers, while in the female a pair of fleshy lobes are found, which are used in placing the eggs in position outside of the body.

Passing now into the interior of the body the most interesting to us are the salivary and poison glands. These are the organs which render the insect so noticeable and mischevious. The mere prick of its tiny lancets would never be noticed but for the injection of the fluid from these glands into the wound. Two of these are found lying in the prothorax. You see one in one of the photographs attached to the head by the poison tube, and appearing like a tiny balloon. It only measures the four-hundredth part of an inch in length, and takes the form of a roundish pear. Interiorly, it is filled with granular matter which stains readily, more especially on the circumference. The long tube by which they are attached to the neck is ringed internally and expands in width as it approaches the gland. In the mosquito the veneno salivary gland divides into three distinct lobes, each having its own separate tubule ; but here each gland consists of but one lobe. At its base, two tiny buds are seen, which may possibly be the analogues of the others found in the mosquito.

At the base of the central lancet lies the aesophagus, or gullet, a stout muscular tube, in which, coupled with capillary attraction, the blood-sucking power rests. Towards the lower part it widens to unite with the stomach. This organ, when empty, is usually found thrown into longitudinal folds, and the large epithelial cells with which it is lined are easily traceable through its walls. At its lower end it slightly thickens encircling the base by a rim, and from this spring two very long Malpighian tubes. They lie upon the outside of the stomach, folded three

or four times up and down on account of their length. On these, at regular intervals, large glandular cells are placed. It is thought that these tubes fulfil functions similar to the liver in animals.

The nervous system consist of the brain and six ganglia united by a double cord of nerves. From each side of these nerve reservoirs branches proceed, which ramify to different parts of the body. The last ganglionic mass in the abdomen is double the size of those preceeding it, as it has to supply the organs of reproduction, as well as the neighbouring structures, with nervous force.

With regard to the function of respiration a peculiar provision for the reception of air is found in the possession of three air sacs. Two lie in the thorax, and the third extends like a bag to the lower part of the abdomen. They are attached to the aesophagus near the neck. The two smaller sacs are probably compensatory additions, which come into play when the abdomen of the female is distended with eggs. Then the pressure of its contents prevent the expansion of the main air sac, so that it is comparatively useless for the time, (as a matter of fact I have generally found it almost empty); then the two thoracic sacs come into play and retain air for the purposes of lightening the specific gravity, and the respiration of the insect. As in the case of the mosquito the air in the sacs is in the form of minute bubbles, separated from each other by an oily film. The sac walls are very transparent, resist most stains, and contain longitudinal and transverse fibres, so that they seem capable of contraction and expansion. The whole of the abdominal organs are subject to a perisaltic movement. They are slowly drawn forward and then thrust backward every few seconds. Thus the process of digestion is aided by the food being moved about in the intestines, and the function of respiration is likewise accelerated by the air being forced through the tracheal tubes.

In the last segment of the female are found two brown oval organs like beans; these are the spermathæca, which secrete the gum by which the eggs are united together. The mosquito possesses three, but only two are found in the sandfly. A slender tube passes from each into the lower bowel, so that their contents can be brought into contact with the eggs as they pass from the ovarian duct to be placed on the outside of the body. The egg sacs occupy in the female a large space in the abdomen. One is placed to the left and the other on the right. A large

tracheal tube passes into each, giving off smaller branches, which further subdivide and ramify throughout the whole of the egg mass.

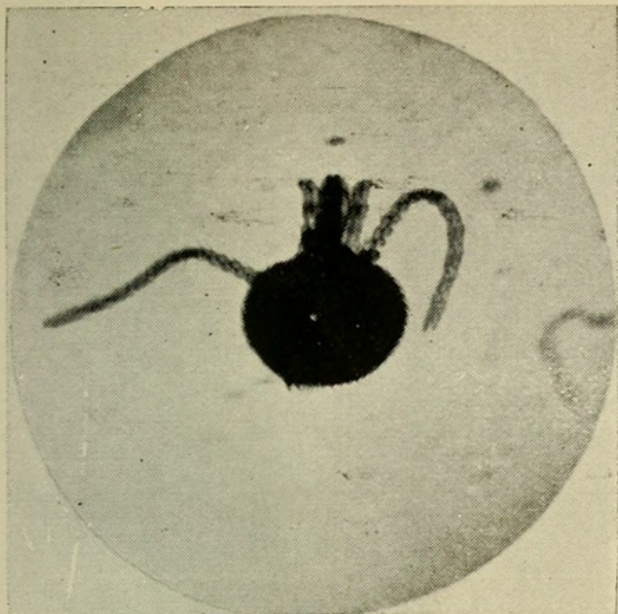
The number of eggs varies, ranging from one to two hundred. The largest number I have found has been two hundred and ten. They measure the one hundred and fiftieth of an inch in length, by half that in breadth. They are oval, yellow, and transparent, looking very like minute gelatine capsules. In the photo given they are laid attached side by side in a long ribbon; but I do not regard this as the normal shape of the egg mass. In captivity insects often do things which they would not in a state of nature, and a judgment formed under these circumstances may prove to be inaccurate, and I have others wherein the shape is much more like the egg-boat of the common mosquito.

The male and female forms are easily recognized by the antennæ. In the former these are of a beautiful plumose shape, the hairs from the basal joints extending nearly to the tips of the organs, but in the female they form a circlet around the base of each joint. Her body also is much stouter, and not so long as the male. He measures nine while she is about seven-hundredths of an inch in length, excluding the antennæ.

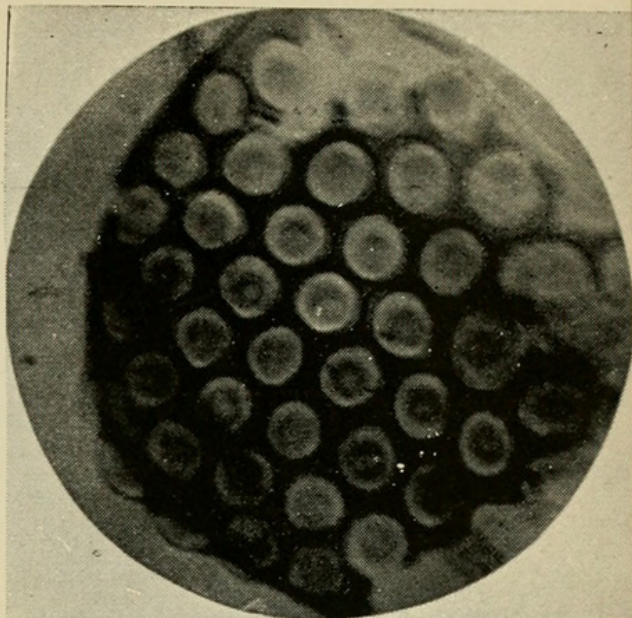
Measurements of MALE Sandfly		FEMALE
Antennæ	·04 inch	·02 inch
Head	·0096	·008
Thorax	·024	·024
Abdomen	·56	·04
Prolegs	·059	·033
Midlegs	·07	·035
Hindlegs	·074	·036
Wings	·064 x ·018	·052 x ·022

PLATES OF SANDFLY.

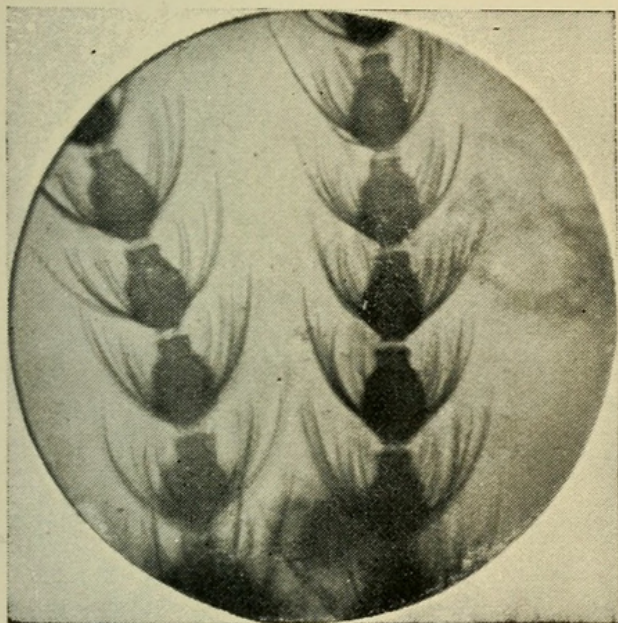
- Fig. 1.—Head of female sandfly, with appendages, x 50.
 „ 2.—Part of eye, x 946.
 „ 3.—Joints of antennæ, x 250.
 „ 4.—Terminal joint of antennæ, x 143.
 „ 5.—Terminal joint of antennæ, showing taste bud, x 500
 „ 6.—Palpi and proboscis, x 250.
 „ 7.—Palpi with first and second lancets, x 250.
 „ 8.—Second and central lancets, x 500.
 „ 9.—Wing, x 50.
 „ 10.—Pro legs, x 38.
 „ 11.—Hind foot, x 80.
 „ 12.—Last foot joint, with hooks, x 272.
 „ 13.—Sketch of pulvilli between hooks.
 „ 14.—Head, with poison gland in centre, x 62.
 „ 15.—Nerve ganglions, with nerve connections, x 60.
 „ 16.—Æsophagus, stomach and abdominal canal, malpighian tubes
 arising from base of stomach, x 60.
 „ 17.—Air sacs attached to head, with egg sacs below, x 21.
 „ 18.—Egg sacs, with one spermothæca in centre, x 55.
 „ 19.—Eggs, with body of mother.
 „ 20.—Male sandfly, x 20.
 „ 21.—Female sandfly, x 20.



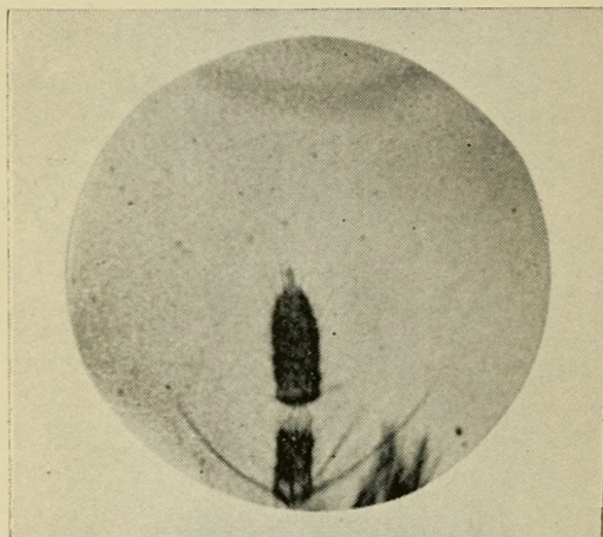
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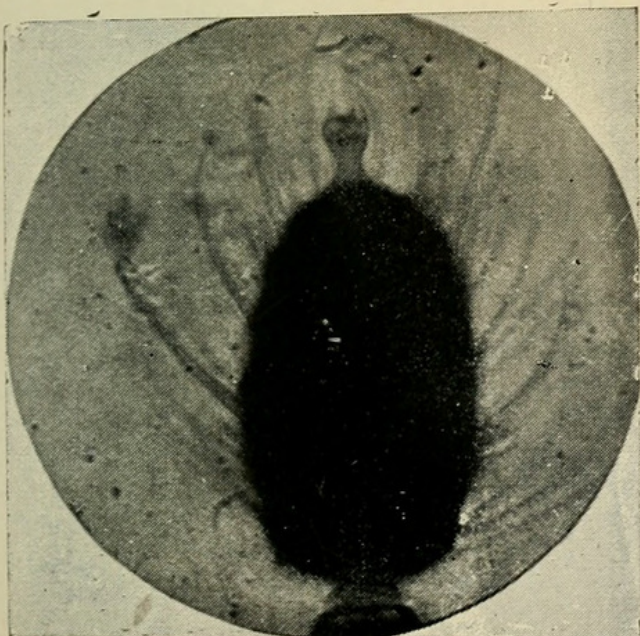
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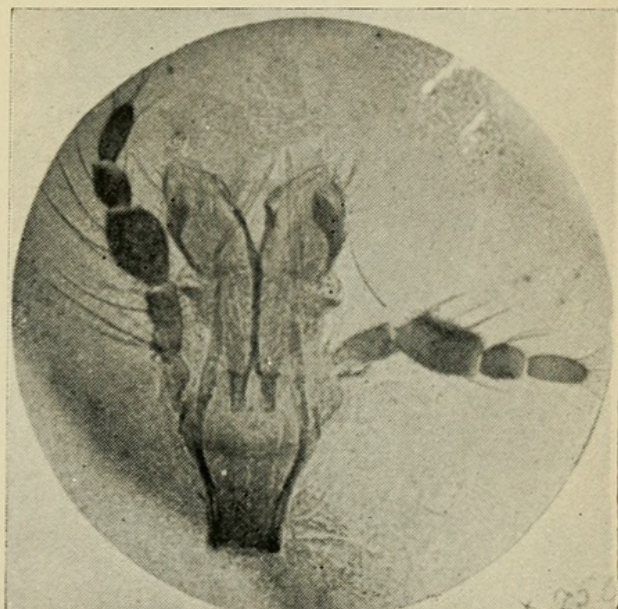
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(4)



(5)



(3)



Colledge, W. R. 1902. "Notes on a Species of Sandfly." *The Proceedings of the Royal Society of Queensland* 17(1), 17–24. <https://doi.org/10.5962/p.351330>.

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