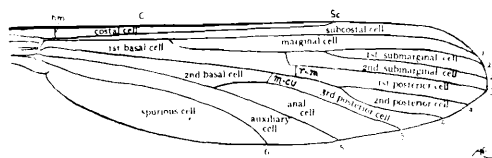


# Mosquitoes

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**M**OSQUITOES belong to the order Diptera or Flies since they possess but one pair of wings, the anterior or front pair. They belong to the family Culicidae which is divided into three subfamilies, all of which are found in the Australian region, Dixinae, Chaoborinae, and Culicinae, the last-named containing by far the greater number of species throughout the world.



**Wing of mosquito.** Mosquitoes may be distinguished from other flies by the position of the veins. Veins 2, 4 and 5 are branched; no other flies possess this characteristic. hm, humeral cross-vein; r-m, radio-medial cross-vein; m-cu, medio-cubital cross-vein.

Modified from Patton and Evans.

There are some two hundred and twenty different kinds of mosquitoes in the Australian region.

The subfamily Culicinae is subdivided into three tribes—Anophelini with two genera, *Anopheles* and *Bironella*, Megarhini with one genus, *Megarhinus*, and Culicini with many genera.

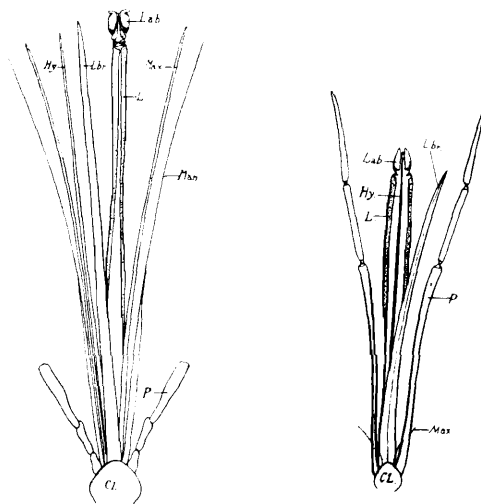
Megarhinus mosquitoes are the largest and among the most beautiful of all mosquitoes—dark blue and golden colours predominating.

Mosquitoes may be distinguished from all other flies, firstly, by the position of the veins of the wing, and secondly, that the entire insect is clothed with scales. They have a long proboscis only in the subfamily Culicinae.

The proboscis (labium) is a hollow sheath which acts as a covering for the mouth parts, and in the female these comprise two mandibles, two maxillae, a

labrum-epipharynx and hypopharynx. The mandibles and maxillae, the jaws, are used for cutting the skin of the victim, while the mouth parts form the food channel up which the female sucks its blood meal—a habit restricted to females. A salivary secretion is injected into the blood as it enters the food channel to prevent clotting.

It is a well-established fact that the mosquito is the worst enemy of man. It spreads malaria, yellow and dengue fevers, and transmits the causative agent of filariasis, a minute worm which lives in the blood stream. Malaria and yellow fever have brought about more deaths and ill health than any other causes, wars included.



**Mouth parts of mosquito.** Right, male; left, female. Cl, clypeus; P, palpi; L, labium; Lab, labella; Lbr, labrum-epipharynx; Hy, hypopharynx; Man, mandible; Max, maxilla. After Kirkpatrick.

Malaria is transmitted by species of the genus *Anopheles*, though not all *Anopheles* are capable of transmitting this disease.

Malaria fever is caused by a microscopic protozoan parasite which lives in the red blood corpuscles of man and on the wall (as cysts) of the stomach of the mosquito, and in the salivary glands as a sporozoite. The parasites belong to the genus *Plasmodium* and possess two distinct phases—one in the mosquito and one in man. Without infected mosquitoes or a carrier, man, there cannot be malaria.

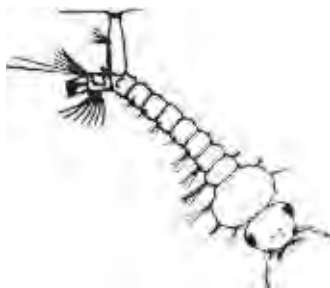


**Anopheles larva feeding.**  
Photo.—Shell Co. of Australia, Ltd.

Yellow and dengue fevers are virus diseases and are transmitted by *Aedes* (*Stegomyia*) *aegypti* among other mosquitoes. The parasites of these diseases are ultramicroscopic. There is a definite period of time in which man is infective to the mosquito and the mosquito to man.

The most efficient intermediate host of the filarial worm, which is the causative agent of filariasis, is *Culex fatigans*, which is found in many parts of the world and is abundant in Australia. A large number of mosquitoes transmit this disease in the tropics and subtropics. In Australia five mosquitoes are efficient intermediary hosts of this parasite.

The duration of the life history of the mosquito in the summer and with an



**Culicine larva feeding.**

abundance of food is about ten to fourteen days.

The eggs of *Anopheles* possess lateral floats and are laid singly. Those of *Stegomyia* are cigar-shaped, can withstand freezing and desiccation over long periods and remain viable and, as in all species of *Aedes* and its subgenera, are laid singly, in some cases above water, where it is damp and water will eventually come. In *Culex* and related genera the eggs, as they are laid, are formed into a raft-shape, with the head of the egg upside down, by the female crossing her hind legs.

The larvae of *Anopheles* are surface feeders and have, in place of the syphon



**Resting attitude. Above, Anophelini;  
below, Culicini.**  
Photo.—Shell Co. of Australia, Ltd.

of the Culicini, a pair of spiracles for the purpose of respiration. The larvae of *Culex* and related genera all possess a moderately long syphon, while the larva of *Aedes* and its relatives has a somewhat short, barrel-shaped breathing syphon. The resting position of all Culicini larvae is at an angle of about 45°.

There is little difference between the pupae of the three groups—the breathing trumpets of the *Anopheles* pupa are somewhat shorter and broader than those of *Culex* pupae while those of *Aedes* are intermediate.

The larvae of Australian *Anopheles* are found in clean water—swamps, hoof-marks of cattle, small collections of casual water, along the grass-grown banks

and eddies of creeks and rivers and rock pools. Some species must have the maximum amount of sunshine while others require only the minimum.

For the most part members of the Culicini breed in similar situations to those of *Anopheles*. A few mosquitoes breed only in the leaf-axils of Pandanus, banana plant, taro and like situations; others breed in cavities of stumps and trees, knot-holes, scars, and where branch joins trunk.

*Aedes* (*Stegomyia*) *aegypti* is essentially a house mosquito. It breeds in all kinds of domestic receptacles which contain clean water. It does not breed in swamps and other ground water. *Aedes* (*Pseudoskusea*) *concolor* is the only true salt-water breeding mosquito. It breeds in rock pools along the foreshores and is abundant at Cronulla, Sydney Harbour

and elsewhere along the coast of New South Wales. *Culex fatigans*, which is also commonly found in houses in Australia, breeds in any dirty or foul water about houses. It prefers septic tanks, liquid manure containers, street gutters and suchlike places to clean water, but it will breed freely in the latter.

The duration of the egg stage is about 36-48 hours, that of the larva seven to ten days, and the pupa about two days. The quantity of food eaten by the larva determines the size of the adult in all insects, since the latter never grow. The pupa is actively motile and does not feed. It is in this stage that the transformation from the larval to the adult characters takes place.

It is a simple matter to distinguish *Anopheles* from all other mosquitoes by their resting position, which is at an angle



Adult *Anopheles* may be distinguished from the Culicini by the palpi; in both sexes these are as long as the proboscis. In the male these are clubbed, but not in the female. In the Culicini the palpi of the male *Culex*, and related genera, are about a segment longer than the proboscis and relatively hairy, but in the female the palpi are about one-quarter as long. In *Aedes*, and most related genera, the male palpi are about the length of the proboscis and almost devoid of hairs; in the female they are about one-eighth the length. There are some exceptions in which the male palpi are very short. Top: left, *Anopheles* head, male; centre, *Culex* head, male; right, *Stegomyia* head, female (after Edwards). Below: *Anopheles* head, female.

Photo.—F. H. Taylor.

of about  $45^\circ$ , whereas that of all other mosquitoes is horizontal to the surface on which they rest.

The thorax of *Anopheles* is very hairy with scattered semi-erect scales; in the Culicini it is densely covered with narrow-curved scales and few hairs. In the subgenus *Stegomyia* the thorax is always ornamented with silvery-white scales distributed in a definite pattern.

The abdomen in *Anopheles* has relatively few scales on it, although in some species it is densely covered with semi-erect scales but never in the same manner as in the Culicini, where they are said to be imbricate—that is, laid like the tiles on the roof of a house. In addition, the abdominal segments have, in many species, basal bands usually of whitish-coloured scales—sometimes apical banding is also present.

Many species of *Anopheles* have multi-spotted wings, others have wings with but a few spots, others again have no spots at all on the wings. Hence it is quite erroneous to think that all *Anopheles* mosquitoes have spotted wings. The greater number of Culicini have wings devoid of ornamentation, though in a few instances these are mottled and some species of *Culex* have spotted wings.

The legs in *Anopheles* are comparatively long and slender with, in some species, conspicuous spots and bands, particularly on the femora and tibiae. In the Culicini the legs are stouter and less ornamented than in *Anopheles* although there are some species, especially those of the subgenus *Stegomyia*, which have the tarsal segments conspicuously banded with white.



Above, wing of *Anopheles*; below, wing of *Stegomyia*.  
Photo.—F. H. Taylor.

Important dates associated with mosquitoes and disease are:

1897. Ronald Ross, afterwards Sir Ronald Ross.

The discovery of the development of the malaria parasite of man and transmission by *Anopheles* species to man.

1898. T. L. Bancroft.

The discovery of the mode of transmission of the filarial worm by the mosquito *Culex fatigans* Wied. from man to man.

1901. Major Reed (Chairman) and Doctors Carroll, Agramonte and Lazear discovered the transmission of the virus of yellow fever in *Aedes (Stegomyia) aegypti*.

1906. T. L. Bancroft.

The discovery of the transmission of dengue fever by the mosquito *Aedes (Stegomyia) aegypti* Linnaeus.