Mosquitoes

Mosquitoes are insects which make up the family Culicidae. They have a pair of scaled wings, a pair of halteres, a slender body, and long legs. The females of most mosquito species suck blood (hematophagy) from other animals, which has made them the most deadly disease vectors known to man, killing millions of people over thousands of years and continuing to kill millions per year by the spread of diseases.

Length varies but is rarely greater than 16 mm (0.6 inch), and weight up to 2.5 mg (0.04 grain). A mosquito can fly for 1 to 4 hours continuously at up to 1–2 km/h travelling up to 10 km in a night. Most species are nocturnal or crepuscular (dawn or evening) feeders. During the heat of the day most mosquitoes rest in a cool place and wait for the evenings. They may still bite if disturbed.

Feeding habits

Both male and female mosquitoes are nectar feeders, but the female of many species is also capable of haematophagy (drinking blood). Females do not require blood for survival, but they do need supplemental substances (like protein and iron) for the development and laying of their eggs. Prior to and during blood feeding, they inject saliva. The Toxorhynchites species of mosquito never drink blood. This genus includes the largest of the extant mosquitoes, the larvae of which are predatory on the larvae of other mosquitoes. These mosquito eaters have been used in the past as mosquito control agents and have varying success .

Mosquitoes hunt their host by detecting CO2 being breathed out from a distance. When they get closer they can also pick up on the infrared heat being emitted which means the host is a warm blooded animal.

Mosquito saliva

In order for a mosquito to obtain a blood meal it must surmount the vertebrate physiological responses. The mosquito, as with all blood-feeding arthropods, has evolved mechanisms to effectively block the hemostasis system with their saliva - a complex concoction of secreted proteins. Mosquito saliva is a pharmacologic cocktail that can affect vascular constriction, blood clotting, platelet aggregation, inflammation, immunity, and angiogenesis. Universally, hematophagous arthropod saliva contains at least one anticlotting, one anti-platelet, and one vasodilatory substance. Mosquito saliva also contains enzymes that aid in sugar feeding and antimicrobial agents to control bacterial growth in the sugar meal . The composition of mosquito saliva

is relatively simple as it usually contains fewer than 20 dominant proteins. Despite the great strides in knowledge of these molecules and their role in bloodfeeding achieved recently, we still cannot ascribe functions to more than half of the molecules found in arthropod saliva.

It is now well recognized that the feeding ticks, sandflies, and, more recently, mosquitoes have an ability to modulate the immune response of the animals (hosts) they feed on. The presence of this activity in vector saliva is a reflection of the inherent overlapping and interconnected nature of the host hemostatic and inflammatory/immunological responses and the intrinsic need to prevent these host defenses from disrupting successful feeding. The mechanism for mosquito saliva-induced alteration of the host immune response is unclear, but the data has become increasingly convincing that such an effect occurs. Early work described a factor in saliva that directly suppresses TNF-α release, but not antigen-induced histamine secretion, from activated mast cells. Experiments by Cross et al. (1994) demonstrated that the inclusion of Ae. aegypti mosquito saliva into naïve cultures led to a suppression of interleukin (IL)-2 and IFN-γ production, while the cytokines IL-4 and IL-5 are unaffected by mosquito saliva. Cellular proliferation in response to IL-2 is clearly reduced by prior treatment of cells with SGE. Correspondingly, activated splenocytes isolated from mice fed upon by either Ae. aegypti or Cx. pipiens mosquitoes produce markedly higher levels of IL-4 and IL-10 concurrent with suppressed IFN-γ production. Unexpectedly, this shift in cytokine expression is observed in splenocytes up to 10 days after mosquito exposure, suggesting that natural feeding of mosquitoes can have a profound, enduring, and systemic effect on the immune response.

T cell populations are decidedly susceptible to the suppressive effect of mosquito saliva, showing enhanced mortality and decreased division rates. Parallel work by Wasserman et al. (2004) demonstrated that T- and B-cell proliferation was inhibited in a dose dependent manner with concentrations as low as 1/7th of the saliva in a single mosquito. Depinay et al. (2005) observed a suppression of antibody-specific T cell responses mediated by mosquito saliva and dependent on mast cells and IL-10 expression. A recent study suggests that mosquito saliva can also decrease expression of interferon−α/β during early mosquito-borne virus infection. The contribution of type I interferons (IFN) in recovery from infection with viruses has been demonstrated in vivo by the therapeutic and prophylactic effects of administration of IFN-inducers or IFN, and recent research suggests that mosquito saliva exacerbates West Nile virus infection, as well as other mosquito-transmitted viruses.

Anatomy

The mosquito is composed of a head, thorax, and abdomen. The head contains two compound eyes and proboscis. The proboscis is a piercing mouthpart used to suck blood from its prey. The mosquito's head is mostly eye. Each eye is made up of many tiny lenses forming a compound eye. This type of eye allows a very big field of vision that easily detects movement. Next is the thorax. The thorax has one pair of wings and one pair of halteres. The thorax also has markings that are used in the identification of the mosquito. The abdomen, or gut, expands as it ingests its prey's blood. The abdomen also has many markings that are used to identify the mosquito species.

Life cycle and feeding habits

In its life cycle the mosquito undergoes complete metamorphosis, going through four distinct stages: egg, larva, pupa, and adult, first described by the Greek philosopher Aristotle.