

Aedes aegypti (Yellow Fever Mosquito)

Order: Diptera (Flies)

Class: Insecta (Insects)

Phylum: Arthropoda (Arthropods)



Fig. 1. Yellow fever mosquito, *Aedes aegypti*.

[http://edis.ifas.ufl.edu/LyraEDISServlet?command=getImageDetail&image_soid=FIGURE%201&document_soid=IN792&document_version=63257, downloaded 29 March 2015]

TRAITS. Adults of *Aedes aegypti* are relatively small and range in size from 4-7mm. *Aedes aegypti* could be mistaken for other species such as *Aedes albopictus*. However, its defining trait is that it possesses lyre shaped white scales on the dorsal surface of the thorax (European Centre for Disease Prevention and Control 2005-2015). White basal bands that appear as stripes are present on each tarsal segment of the hind legs. Their abdomens are dark brown generally, which may also possess white scales (Zettel and Kaufman, 2013). Females (Fig. 1) are larger than males (Fig. 2) and are distinguished by minute palps with silver or white scales present on their

tips. Females also differ from males in that they have short, sparse hairs whereas males have plumose antennae. Since males feed primarily on nectar, their mouthparts are adapted for nectar feeding and since females predominantly consume blood, their mouthparts are adapted for blood feeding. Common to both male and females is a dark proboscis (tongue). *Aedes aegypti* was formerly known as *Culex aegypti* and other names (Zettel and Kaufman, 2013).

DISTRIBUTION. The European Centre for Disease Prevention and Control (2005-2015) provides a substantial listing of the countries in which *Aedes aegypti* exists. It is native to Africa and is now globally distributed in tropical, subtropical and mild temperate regions, including Trinidad and Tobago. They spread to more temperate regions during the summer months (Fig. 3). Their distribution is restricted due to their intolerance of temperate winters. Globalization of trade has influenced the distribution of this invasive species.

HABITAT AND ACTIVITY. *Aedes aegypti* utilizes both natural and artificial habitats. Their habitats may also be either terrestrial or aquatic. *Aedes aegypti* utilized tree holes and plant axils (leaf joints) found in forested areas as aquatic habitats historically. Their adaptation to urban domestic habitats have led to the exploitation of a range of artificial containers frequently associated with human habitation which include vases, water tanks and tyres. They also use aquatic habitats such as septic tanks which are located underground and are capable of using aquatic habitats situated indoors and outdoors. *Aedes aegypti* larvae require standing water for the completion of their growth cycle. Therefore potential breeding habitats are places that contain standing bodies of water (Dom et al., 2013).

Their activity is both diurnal and crepuscular (Zettel and Kaufman, 2013). Their circadian rhythm is comprised of oviposition, blood feeding, sugar feeding and copulation at 6:00am; atypical blood feeding between 10-12noon; adults resting indoors and outdoors 12-15.00; atypical blood feeding at 18.00-21.00; adults resting indoors and outdoors at 21.00-5.00 (Chadee, 2013). One study showed that diel periodicity for females was predominantly diurnal and bimodal, with steep peaks at 06-07h a.m. (post-sunrise) and 5-6h p.m. (pre-sunset) (Nunes de Lima-Camara, 2010). Their activity also varies with changes in environmental conditions. It is known that mosquitoes' circadian rhythms such as flight, locomotion, oviposition and blood-feeding are endogenously controlled and therefore this is reflected in their activities (Nunes de Lima-Camara, 2010). Generally their activity often ranges from about two hours after sunrise and a few hours before sunset (California Department of Public Health, n.d.)

FOOD AND FEEDING. The female *Aedes aegypti* feeds almost exclusively on humans. They feed on a lower frequency of other hosts including bovine, swine, cat, rat, and chicken which represents <1% of bloodmeals (Ponlawat and Harrington, 2005). Females are particularly active biters and feed readily and consistently under most circumstances when given the opportunity. The males do not attempt to puncture skin. The female may however maintain existence for long periods on food other than blood. Both sexes feed on sugar-containing fluids, fluids from flowers and fruits. Organic particulate matter present in the water provide food for larvae (Zettel and Kaufman 2013). Feeding on humans generally occur at one to two hour intervals. The mosquito typically attacks from below or behind, typically from beneath desks and chairs. They usually attack the feet and ankles (DengueVirus.net, 2015).

POPULATION ECOLOGY. *Aedes aegypti* is an abundant species. With regards to their interaction with other species, they share larval habitats with other mosquitoes such as *Aedes albopictus* among others which also breed in containers (Womack, 1993). In keeping with their interaction with other species *Aedes aegypti* are parasites and also undergo interspecific competition with *Aedes albopictus* and *Aedes triseriatus*.

REPRODUCTION. Mating occurs in swarms, consisting of mostly males with the females entering separately. *Aedes* males do not require the formation of such swarms to attract females and mate (Oliva et al., 2013). They demonstrate wide behavioural plasticity that allows them to mate in single pairs or in aggregations. The flexibility permits mating throughout the day though crepuscular peaks have been observed. *Aedes* swarming activity is a mate – locating behaviour which enhances mating opportunities and increases copulation frequency but is not a required behaviour (Oliva et al., 2013). Once compatible partners are found, the mating couple forms a union known as a copula. *Aedes* males usually first grasp the female dorsally and then rapidly change to the ventral position. The 180° rotation of mosquito genitalia allows the claspers to be ventrally oriented and this position allows them to grasp the females' cerci. Copulation lasts less than one minute; it was found that 6 seconds was sufficient for insemination (Oliva et al., 2013).

“Aggregation pheromone” produced by swarming males stimulate both female and male flight and attracts both sexes to the swarm. In response to this olfactory stimulus, females show a characteristic rapid agitated flight. Female wing beat also attracts males as the females' frequency has been shown to stimulate male *Aedes* to pursue and seize the female. Males would not attempt copulation with non-flying females nor with newly-emerged females, which have a different wing beat frequency than mature ones (Oliva et al., 2013). The mosquito lays her eggs approximately 3 days subsequent to feeding on blood. Females produce approximately 100-200 eggs per batch and about 5 batches of eggs for the duration of her lifetime. However the size of the blood meal usually determines the quantity of eggs produced. The eggs are not laid contiguously, but the laying of an entire clutch can be dispersed over hours or days and over two or more sites, depending on the availability of suitable substrates. Due to *Aedes aegypti* being holometabolous its metamorphosis comprises of an egg, larva, pupa and adult stage and an entire aquatic cycle can occur in roughly 7-8 days (Fig. 4).

BEHAVIOUR. Larval behaviour: Larvae consume the aquatic microbiota which develops in artificial containers. Food supply and water temperature influences the total time it takes for larvae to develop through all four instars. This total time period usually ranges from four to ten days. Temperatures below 10°C and above 44°C results in the death of larvae (Womack, 1993).

Anti-predator behaviour: *Aedes aegypti* is a food source for both aquatic and terrestrial animals. Their aquatic larval forms are preyed upon by small fishes such as perch, bluegills and sunfish as well as crustaceans called copepods together with other aquatic organisms. Adults are eaten by small reptiles, birds and amphibians. Mosquito pupae react to visual and physical disturbance by swimming downwards.

APPLIED ECOLOGY. *Aedes aegypti* is cited by the Global Invasive Species Database (2006), as a domestic vector of the yellow fever virus. It goes on to elaborate that in the Americas (before the 1940s) and recently in West Africa it was responsible for an epidemic of the yellow fever virus. *Aedes aegypti* is also the most important carrier of the dengue virus (Global Invasive Species Database, 2006). Chikungunya virus and Zika virus has also been shown to be

transmitted by *Aedes aegypti* together with the West Nile virus (European Centre for Disease Prevention and Control 2005-2015). Control strategies are aimed at preventing mosquito bites, maintaining populations at “acceptable” densities, minimizing mosquito-host contact and reducing the longevity of female mosquitoes. It incorporates the concept of vector and disease control. Personal protection involves the use of domestic insecticides, repellents (natural or synthetic), insecticide treated materials and paints. Control also incorporates both biological and chemical methods (Fig. 5).

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Fig. 2. Male *Aedes aegypti* in flight.

[<http://www.oxitec.com/wpcms/wp-content/uploads/Single-OX513A-Aae-male-in-flight1-600x480.jpg>, downloaded 4 April 2015]

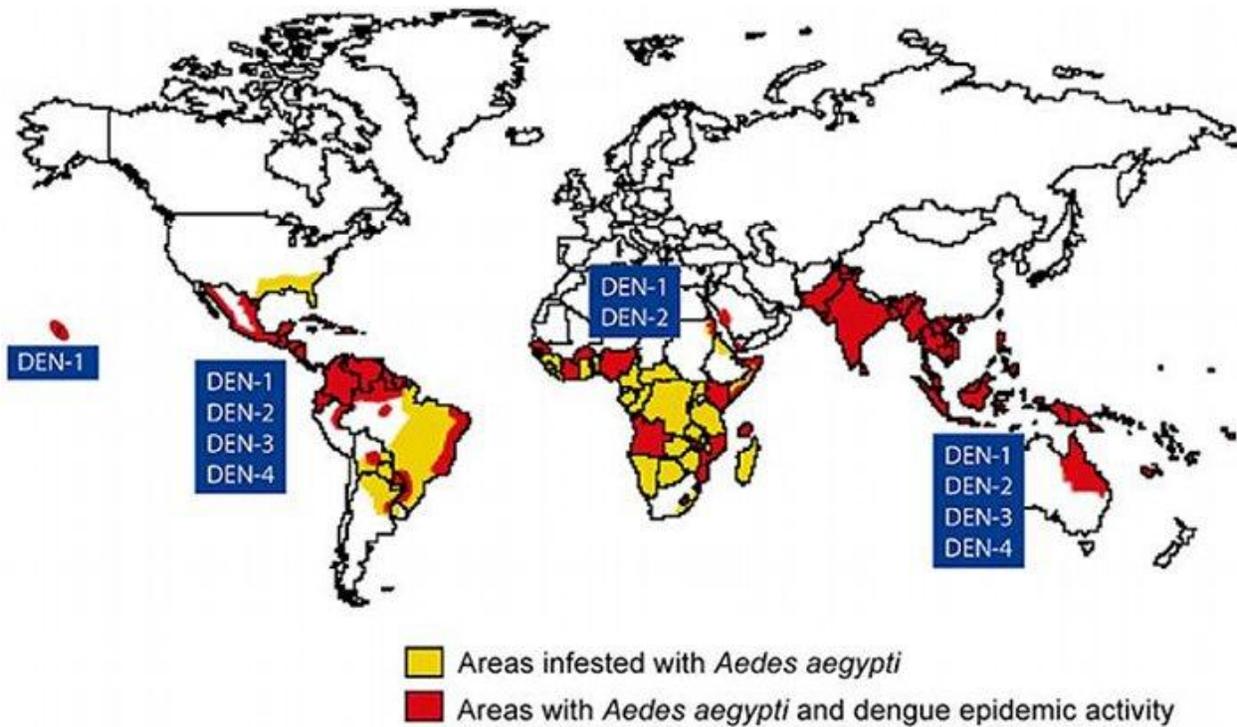


Fig. 3. *Aedes aegypti* geographic distribution in addition to dengue epidemic activity.

[<http://www.chikungunya.in/images/global-distribution-of-aedes-aegypti.jpg>, downloaded 4 April 2015]

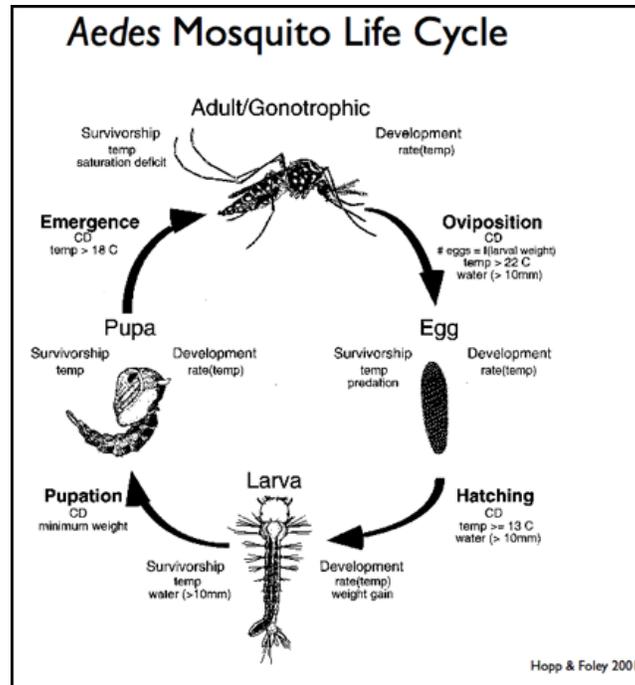


Fig. 4. The life cycle of *Aedes aegypti*.

[http://1.bp.blogspot.com/-bM6lOHG_LrM/ThYhTvdTN9I/AAAAAAAAAHwE/CpmKrvDoZdk/s640/aedes-aegypti+life+cycle+2.png, downloaded 4 April 2015]



Fig. 5. Fogging machines used as a chemical means of eradicating *Aedes aegypti*.

[<http://www.compasscayman.com/uploadedImages/caycompass/2014/06/27/Skeeter-Spray-1.jpg>, downloaded 04 April 2015]

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