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## EXERCISE 17 ARTHROPODA-V : LIFE HISTORY STAGES OF *ANOPHELES*, *CULEX* AND *AEDES* MOSQUITOES FROM PERMANENT SLIDES

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### 17.1 INTRODUCTION

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All of us are familiar with mosquitoes due to their bites. Mosquitoes are tiny creatures, slender in appearance and are generally found in damp and marshy places near stagnant water. Mosquitoes are found all over the world except in hilly cold regions. You must have seen mosquito larvae, wriggling in the drains near your house or in stagnant pools of water in your neighbourhood. They are found specially abundantly in the tropics. The females are sanguivorous (blood-feeders), feeding on the blood of humans and other vertebrates. The males only suck the juices of flowers, fruits, etc. You will be able to distinguish male from female by the poorer development of their mouth parts and by their bushy antennae. Mosquitoes are nocturnal creatures biting only at dusk or night. They are important from the stand point of human welfare. They transmit several important human diseases like malaria, yellow fever, dengue, filariasis and Japanese encephalitis.

#### Objectives

After performing this exercise, you should be able to

- identify and differentiate between Anopheline and Culicine mosquitoes,
- identify life-history stages of *Anopheles*, *Culex* and *Aedes* mosquitoes,
- draw and label life-history stages of above three mosquitoes.

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### 17.2 MATERIAL REQUIRED

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1. Specimens/Mounts of eggs, larva, pupa and adults of *Anopheles*, *Culex* and *Aedes*.
2. Microscope (compound)
3. Practical Note book for record

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### 17.3 METHOD

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Examine the slides carefully under low power of the compound microscope and compare what you have observed with the description and figures provided in the lab exercise. After viewing one slide you may move to next until you complete viewing the entire series.

In your note book sketch, label and write the description. The slides which you will be examining and for which descriptions are provided are listed below:

1. Eggs of *Anopheles*
2. Eggs of Culicines – *Culex* & *Aedes*
3. Larva of *Anopheles*
4. Larva of *Culex*
5. Larva of *Aedes*
6. Pupa of *Anopheles*
7. Pupa of *Culex*
8. Pupa of *Aedes*
9. Adult *Anopheles*
10. Adult of *Culex*
11. Adult of *Aedes*

## 17.4 GENERAL DESCRIPTION ABOUT MOSQUITOES

Before you start studying the slides, carefully go through the description of life cycle of the mosquitoes given in the Introduction and the various figures provided throughout the laboratory exercise. This will help you to become familiar with the various developmental stages in the life-cycle of mosquito.

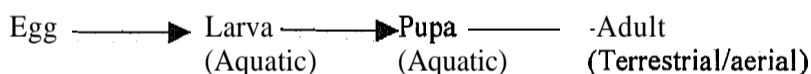
The mosquitoes belong to the order **Diptera**. There are about 2700 known species. The important genera are *Anopheles*, *Culex* and *Aedes*. Table 17.1 gives the classification of mosquitoes.

**Table 17.1: Scientific classification of mosquitoes.**

Kingdom	<b>Animalia</b>	Animals, multi-cellular organisms with cells that lack a cell wall, many capable of movement or movement of some of their body parts or capable of movement at some time of their life cycle; heterotrophic nutrition.
Phylum	<b>Arthropoda</b>	Bilaterally symmetrical triploblastic and segmented. Limbs jointed, exoskeleton chitinous.
Class	<b>Insecta</b>	<b>3</b> pairs of limbs/legs; Body differentiated into head, thorax and abdomen
Division	<b>Endopterygota</b>	Metamorphosis complete
Order	<b>Diptera</b>	Only one pair of wings (forewings) is present, hind wings reduced to halteres
Family	<b>Culicidae</b>	
Common genera	<i>Anopheles</i> , <i>Aedes</i> , <i>Culex</i>	
Common name	<b>Mosquito</b>	

The body of a mosquito is about 3 to 6 millimeter long, soft, slender and covered with scales. Colour of the body is greyish to black. Body is divided into **three** distinct parts: head, thorax and abdomen (Fig. 17.1).

Life cycle of mosquitoes is an example of **complete metamorphosis**. It includes the following stages:



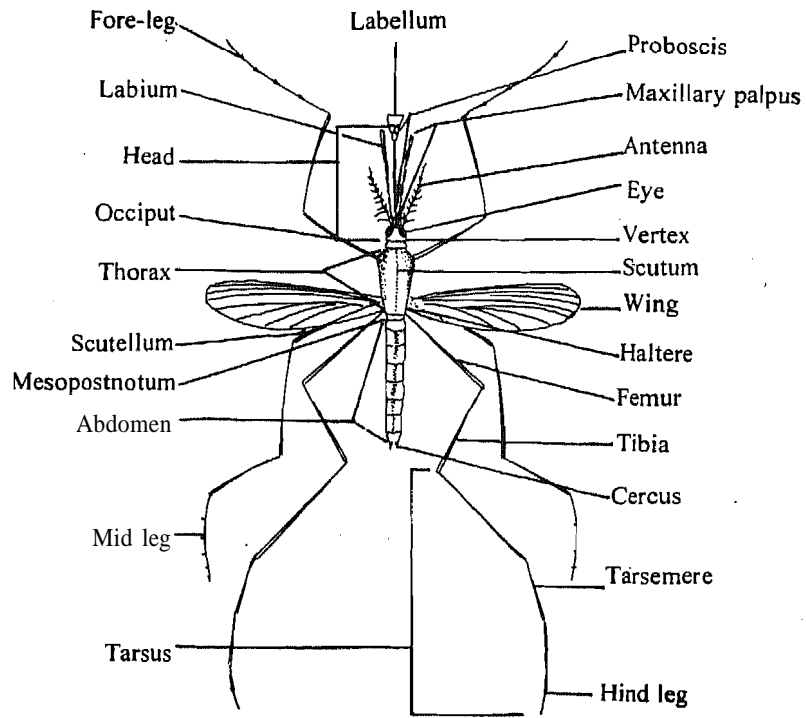


Fig. 17.1: General diagram of a female adult mosquito.

Table 17.2: Differences between Anopheline and Culicine mosquitoes.

Culicines	Anaphelines
<b>EGGS</b>	
1. Shape: Elongated, cigar-shaped and no lateral air floats.	1. Boat-shaped with paired lateral air-floats which help in floatation.
2. Manner of laying: The eggs are laid vertically on the surface of water singly in <i>Aedes</i> and in raft in <i>Culex</i> .	2. Eggs are laid singly and horizontally on the water surface and remain separate.
3. Number: 100-170 eggs are laid at a time by female.	3. The number of eggs laid at a time varies from 80-140.
4. Medium: The eggs are laid in dirty water collected in the vicinity of houses in <i>Culex</i> while in <i>Aedes</i> eggs are laid on moist surface at the water's edge. Withstand desiccation.	4. The eggs are laid in clear and fresh water. (Fig. 17.2)
<b>LARVA</b>	
1. Posture: The larva hangs from the surface of water position forming an angle of 45° with the water surface with head down.	1. The larva lies horizontally parallel to water surface.
2. Feeding habit: It is bottom feeder, because the head lies at the bottom. It feeds on the microscopic organisms present at the bottom of the pond.	2. It is surface feeder and utilizes the food present in the upper strata of water.
3. Respiratory siphon: The respiratory siphon is long, tubular and conical, the opening of which can be closed by lid like terminal flaps.	3. The respiratory siphon is very much reduced or absent because the spiracles are situated on 8 <sup>th</sup> segment of abdomen.
4. Dorsal hair: Dorsal palmate hair are absent.	4. Palmate hair are present on the dorsal surface of abdominal segment from 2 <sup>nd</sup> to 7 <sup>th</sup> .
5. Tracheal gills: The last abdominal segment carries four tracheal gills.	5. Tracheal gills are wanting, (Fig. 17.2)
<b>PUPA</b>	
1. The respiratory trumpets are long and narrow and with small terminal aperture.	1. The respiratory trumpets are small, broad and with large terminal opening. (Fig. 17.2)

ADULT	
1. <b>Body built:</b> The body of <i>Culex</i> is well built with legs.	1. The body of <i>Anopheles</i> mosquito is slender and delicate and the legs are weak.
2. <b>Body colour:</b> The body is greyish and without hair. In <i>Aedes</i> , body highly ornamented with silvery spots/bands on thorax, abdomen, legs.	2. The body is greyish in colour and covered with hair.
3. <b>Wings:</b> Wings spotted with only dark scales.	3. Wings spotted with white and dark scales.
4. <b>Abdomen:</b> Abdomen is covered with uniform rows of overlapping flat white and dark scales.	4. Abdomen is without scales or with few scattered scales.
5. <b>Scutellum:</b> The scutellum is trilobed.	5. The scutellum is rounded.
6. <b>Resting posture:</b> When at rest, proboscis and body are not in a straight line. the abdomen being inclined towards resting surface.	6. When at rest, proboscis, head, thorax and abdomen arc in a straight line with abdomen pointing away from the resting surface making an acute angle with the surface.
7. <b>Maxillary palps:</b> The maxillary palps of male are longer than the proboscis and those of female are shorter than the proboscis.	7. The maxillary palps are as long as the proboscis in both the sexes, but are clubbed at the distal ends in male. (Fig. 17.2)

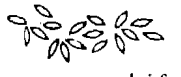
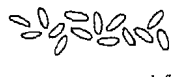







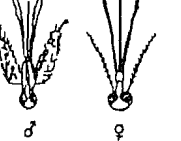
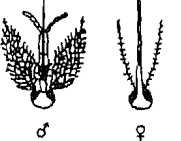
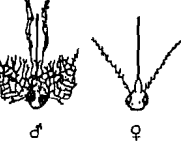
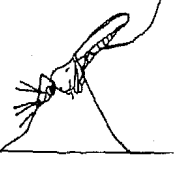
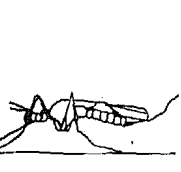
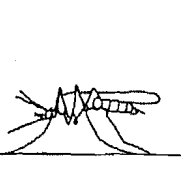
	ANOPHELINES		CULICINES	
	ANOPHELES	AEDES	CULEX	
EGGS				
	Life-span = 1.5 - 2 days			
LARVA				
	Life-span = 6 - 8 days			
PUPA				
	Life-span = 1.5 - 2 days			
HEAD				
RESTING POSITION				
<p>LONGEVITY</p> <p>Female approximately 30 days under ideal natural conditions</p> <p>Male 2 to 6 days</p> <p>FAVOURABLE CLIMATIC CONDITIONS</p> <p>Daily mean temperature - 28°C to 30°C</p> <p>Daily mean relative humidity - 60 - 80%</p>				

Fig. 17.2: Differences between various developmental stages of *Anopheles*, *Culex* and *Aedes* mosquitoes.

## 17.5 OBSERVATION OF LIFE-HISTORY STAGES OF ANOPHELES, CULEX AND AEDES

You are now familiar with the life-stages of mosquitoes. Now we provide you a brief description of stages of mosquito life cycle. You should sketch what you observe under the microscope in your notebook. Label and give the descriptive features.

### 17.5.1 Eggs

#### a. Eggs of *Anopheles*

- i) About 0.5 – 1.0 mm in length.
- ii) Boat-shaped and with paired lateral air-floats.
- iii) Laid singly on clear water.
- iv) Egg has a flattened upper surface the "deck" and keel-shaped lower surface remains submerged.
- v) Colour of the eggs is brown but when freshly laid it is white (Fig. 17.3).

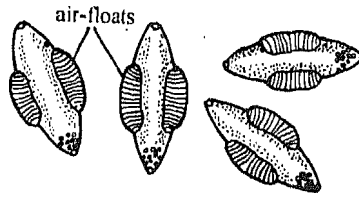


Fig. 17.3: Egg of *Anopheles*.

#### b. Eggs of *Culex*

- i) Laid in raft
- ii) Raft measures 3-4 mm long and 2-3 mm wide.
- iii) Devoid of air-floats
- iv) Eggs are tapered at the free end (Fig. 17.4).

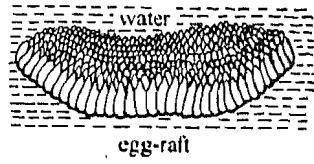


Fig. 17.4: Egg of *Culex*.

#### c. Eggs of *Aedes*

- i) Elongated, tapered at the end and blackish in colour.
- ii) Laid in a batch but not attached to each other
- iii) Air-floats absent
- iv) Laid on the moist surface at the water's edge and not the water itself.
- v) Can withstand desiccation (Fig. 17.5).



Fig. 17.5: Egg of *Aedes*.

### 17.5.2 Larvae

#### a. Larva of *Anopheles*

- i) Commonly known as wriggler.
- ii) Body elongated and differentiated into head, thorax and abdomen.
- iii) Head with paired compound eyes, antennae, mandibulate mouth-parts and feeding brushes.
- iv) Thorax is unsegmented and broader than the head or abdomen, flattened and limbless.
- v) Thorax has several groups of hair.
- vi) Abdomen is long and cylindrical, comprised of 9 segments.

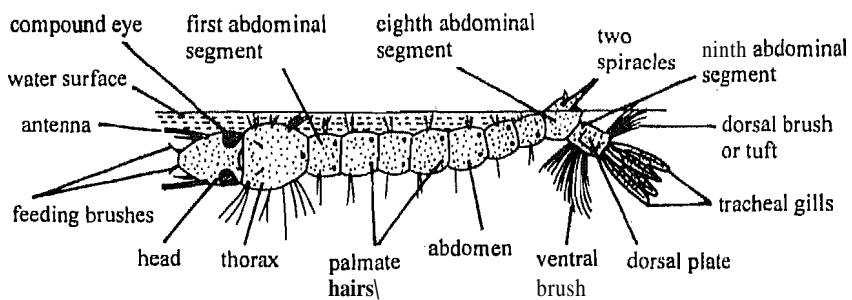


Fig. 17.6: Larva of *Anopheles*.

- vii) First segments are similar and each has palmate hair.

- viii) 8<sup>th</sup> and 9<sup>th</sup> segments are modified and 8<sup>th</sup> segment bears the respiratory apparatus which consists of paired spiracles.
- ix) Ninth abdominal segment bears rudder bristles and tracheal gills.
- x) It rests horizontal and parallel to the water surface.
- xi) Larva hatches into pupa (Fig. 17.6).

**b. Larva of Culex**

- i) Body is divided into 3 parts: Head, Thorax and Abdomen.
- ii) Head has a pair of compound eyes, a pair of jointed antennae, in front, you will see a pair of special branches of hair, known as *feeding* brushes.
- iii) Thorax is slightly broader than head, unsegmented and limbless.
- iv) Thorax bears 3 pairs of lateral tufts of hair, each tuft springing from a small tubercle.
- v) On the dorsal side of 8<sup>th</sup> abdominal segment is located a long tube which is respiratory siphon. At the tip of the siphon, a pair of spiracles are present, which are opening of tracheal system.
- vi) To the last segment are attached four small leaf like tracheal gills surrounding the anus. These tracheal gills contain tracheae and probably take oxygen dissolved in water.
- vii) The last segment also bears a tuft of rudder bristles which helps in swimming.
- viii) Palmate hair are absent (Fig. 17.7).

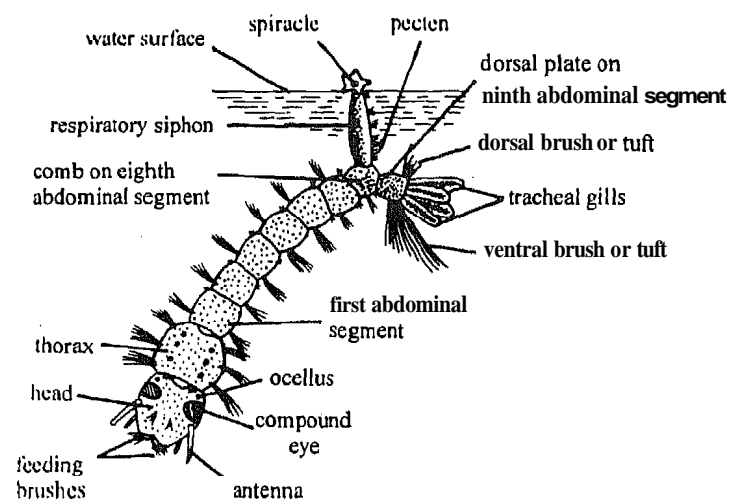


Fig. 17.7: Larva of Culex.

**c. Larva of Aedes**

- i) Cylindrical and elongated form.
- ii) White in colour except head and siphon which are black in colour.
- iii) Head is globular and is small in relation to thorax.
- iv) Head carries feeding brushes, antennae.
- v) Antennae are small, cylindrical and smooth.
- vi) Thorax is roughly globular in shape and contains lateral hair.
- vii) Abdomen 9 segmented, 8 equal segments with a small additional terminal anal segment.
- viii) Each segment carries a series of hair.
- ix) At the posterior lateral aspects of the 8<sup>th</sup> segment in each side is conspicuous row of spiny scales, comb teeth, forming a single row of 8-12 teeth.
- x) Respiratory siphon on the 8<sup>th</sup> segment.
- xi) Anal gills on the last segment (Fig. 17.8).

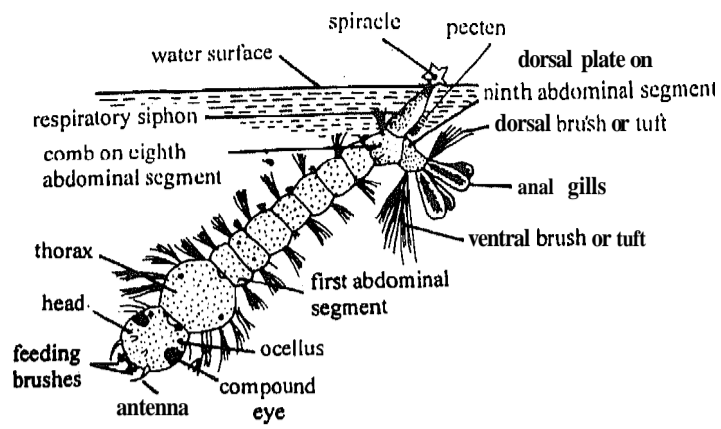
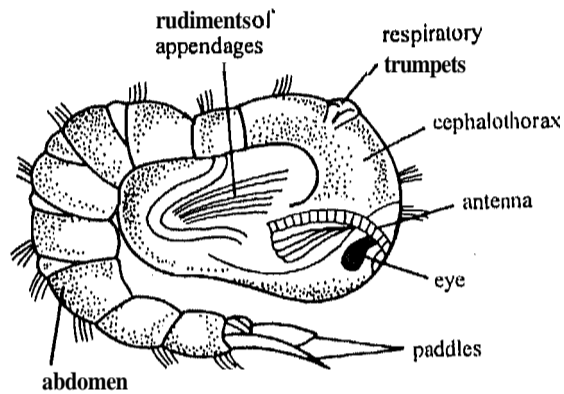


Fig. 17.8: Larva of *Aedes*.

### 17.5.3 Pupae

#### a. Pupa of *Anopheles*

- i) Body comma-shaped, differentiated into cephalothorax and abdomen.
- ii) Abdomen eight-segmented with the pair of paddles at the tip and flexed below the cephalothorax.
- iii) Respiratory trumpets shorter than those of pupa of *Culex* and on the upper surface.
- iv) Cephalothorax covered by transparent puparium.
- v) Compound eyes on the sides of the head.
- vi) Non-feeding stage but very active.
- vii) Emerges into terrestrial imago (Fig. 17.9).

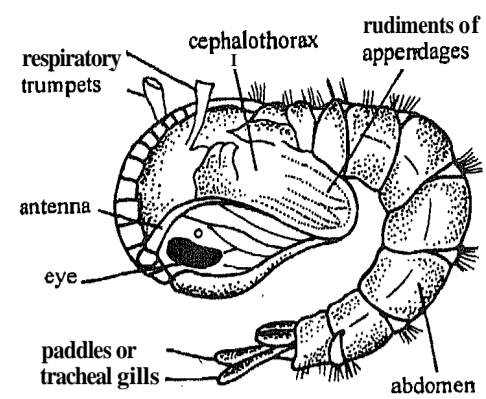


Pupa of *Anopheles*

Fig. 17.9: Pupa of *Anopheles*.

#### b. Pupa of *Culex*

- i) Body comma-shaped, differentiated into cephalothorax and abdomen.
- ii) Respiratory trumpets large and funnel-shaped.
- iii) Cephalothorax covered by transparent puparium.
- iv) Compound eye on the side of the head.
- v) Non-feeding but very active stage.
- vi) Emerges into adult mosquito which is terrestrial (Fig. 17.10).



Pupa of *Culex*

Fig. 17.10: Pupa of *Culex*.

**c. Pupa of *Aedes***

- i) Comma-shaped.
- ii) Body divided into cephalothorax and abdomen which is flexible.
- iii) Breathing trumpets are cylindrical in shape.
- iv) Tail fins or paddles are almost circular in shape, being slightly longer than broad.
- v) Non-feeding but very active stage.
- vi) Intermediate stage between larval and adult mosquito (Fig. 17.11).

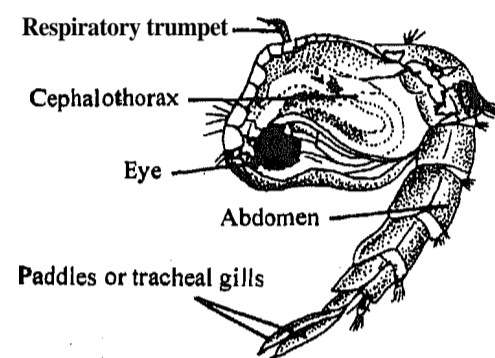


Fig. 17.11: Pupa of *Aedes*

**17.5.4 Adults**

**a. Adult *Anopheles***

- i) Body is divided into head, thorax and abdomen.
- ii) Head bears mouth parts, compound eyes and antennae.
- iii) Maxillary palps are as long as the proboscis in both the sexes but clubbed at the distal end in the male.
- iv) The thorax carries a pair of wings, three pairs of legs and a pair of halteres.
- v) Abdomen has 8 similar segments.
- vi) Last segment is modified into terminalia for mating and for ovipositing.
- vii) Rests at an angle keeping proboscis, head, thorax and abdomen in a straight line.
- viii) Breeds in clean ponds, rain water collections, slow moving streams (Fig. 17.12).



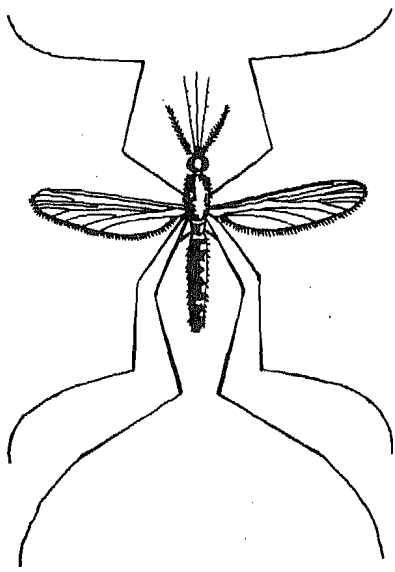
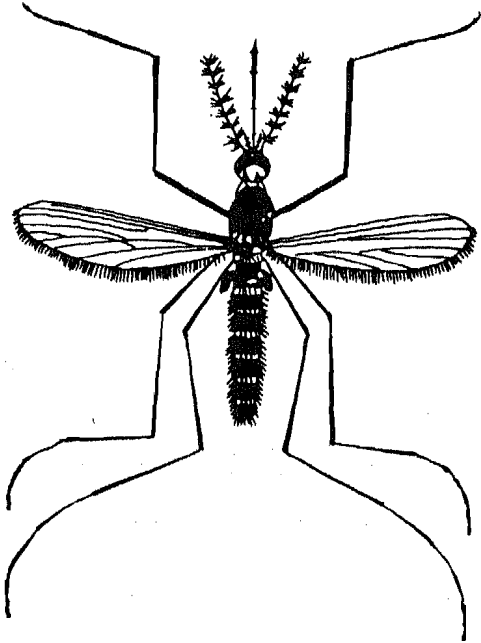


Fig. 17.12: Adult *Anopheles* mosquito.

**b. Adult *Culex***

- i) Stronger body than that of *Anopheles*.
- ii) Body is divided into head, thorax and abdomen.
- iii) Head bears mouth-parts, compound eyes and antennae.
- iv) Maxillary palps of **male** are longer than the proboscis and those of **females** are shorter than the proboscis.
- v) The thorax carries a pair of wings, three pairs of legs and a pair of halteres.
- vi) Wings have only dark spots.
- vii) Abdomen has **8** similar segments.
- viii) Last segment is modified into terminalia for **mating** and for ovipositing.
- ix) Rests parallel to the surface, proboscis and body being not in straight line, the **abdomen** being inclined towards the resting surface.
- x) Breeds in polluted water pools such as soakage pits, and ponds of sewage works (Fig. 17.13).



**c. Adult *Aedes***      Fig. 17.13: Adult *Culex* mosquito.

- i) Body **highly** ornamented and divided into head, thorax and abdomen.
- ii) Head bears mouth-parts, compound eyes and antennae,

- iii) Maxillary **palps** of male are longer than the proboscis and those of females are shorter than the proboscis.
- iv) Thorax has relatively large accomodative legs, wings and the halteres.
- v) Abdomen 9 segmented, 1" eight segments are similar, while 9<sup>th</sup> is modified for reproductive **funtion**.
- vi) Brilliant silvery broad scales on the thorax and white spots on the legs.
- vii) In abdomen markings are formed by white, pale or yellow scaling shown up on a black background.
- viii) Basal banding on abdomen is pale.
- ix) Container breeder i.e., breeds in vases, waterjars, **tyres**, desert coolers, overhead water tanks etc.
- x) Urban mosquito (very common in cities)
- xi) Bites during day time (**Fig. 17.14**).

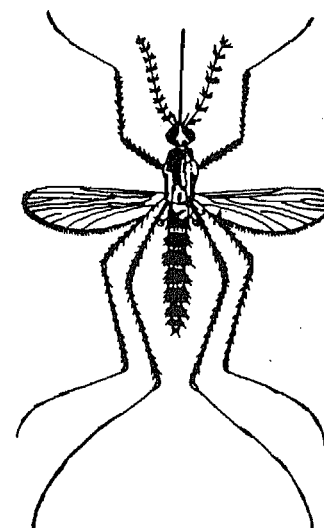


Fig. 17.14: Adult *Aedes* mosquito.

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### 17.6 TERMINAL QUESTIONS

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1. With the help of labelled diagram show the different stages in the life cycle of *Anopheles*. (No description)

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2. Draw a labelled diagram of larva and pupa of *Anopheles* and *Culex* mosquito.

3. Fill in the blanks.

- i) Life cycle of a mosquito is an example of ..... metamorphosis.
- ii) A mosquito has ..... pair of wings.
- iii) Body of mosquito is divided into ..... regions.