# ASSIGNMENT - II

# ENTOMOLOGY

Entomology

Date: 9/9

PR-1

a) Medical Entomology : It is the branch of entomology which deals with arthropods of medical and public health importance which are responsible for transmitting diseases to human beings either directly or indirectly.

b) Arthropods of medical importance

| b) Arthropods of medical importance | | |
|---|---|---|
| Class: Insecta | Class: Arachnida | Class: Crustacea |
| 1 MOSQUITOE : Anopheles; Culcines | 1 TICKS : Hard ticks; Soft ticks | 1 CYCLOPS |
| 2 FLIES: Houseflies; TseTse; sandfly; black fly | 2 MITES : Trombiculid mite; (chiggers) Itch mite | |
| 3 HUMAN LICE : Crab lice; Head & body lice | | |
| 4 FLEAS : Rat flea; sand flea | | |
| 5 BUGS : Reduviid bugs; Bed bugs | | |

c) tive Characteristics of arthropods of medical importance

| | Insecta | Arachnida | Crustacea |
|---|---|---|---|
| Body division | Head<br>Thorax<br>Abdomen | Cephalothorax<br>Abdomen<br>(no division in some cases) | Cephalothorax<br>Abdomen |
| Legs | 3 pairs | 4 pairs | 5 pairs |
| Antennae | 1 pair | none | 2 pairs |
| Wings | 1 or 2 pair; some wingless | none | none |
| Where found | on land | on land | in water |

# MOSQUITOES

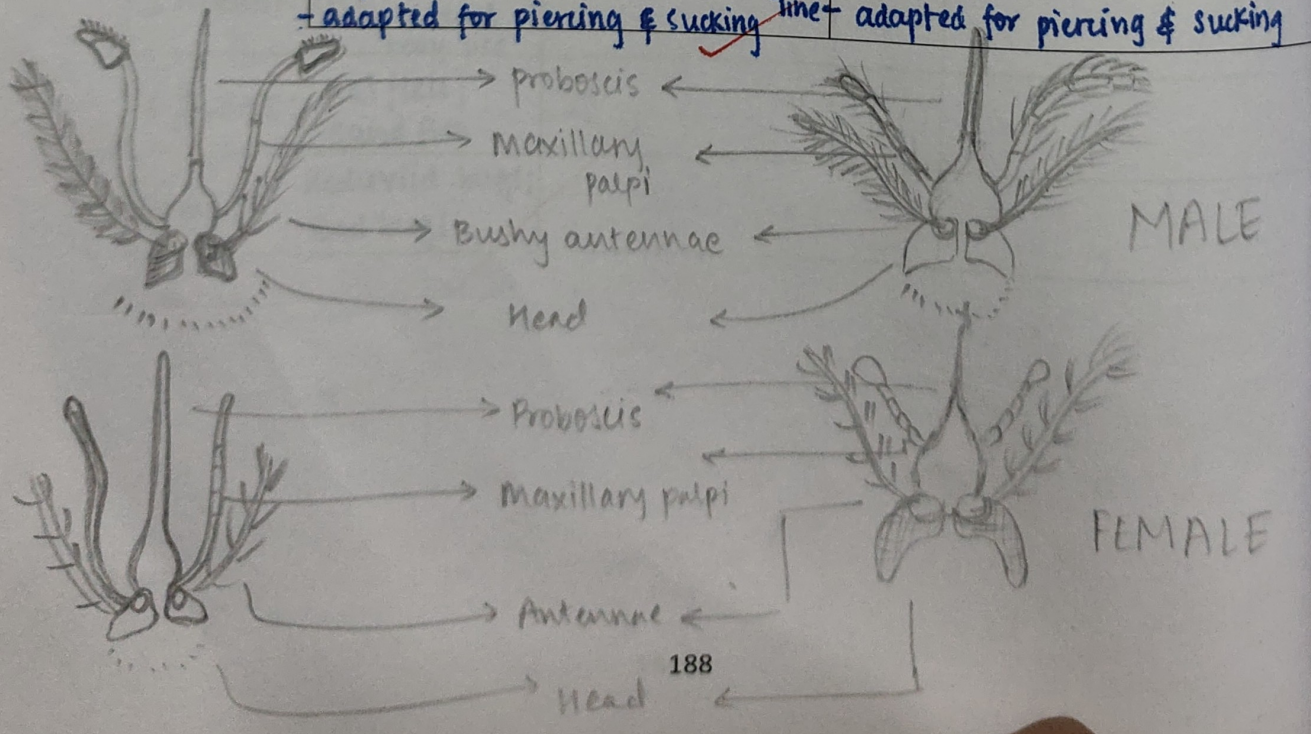
General Description

MOUTH PARTS OF MOSQUITO

- Labium
- Labrum
- Mandibles (pair)
- Maxillae (pair)
- Maxillary palpi
- Hypopharynx
- Clypeus + proboscis
- Stylets

Differentiating features between Anopheles & Culex mouth parts

| | Anopheles | Culex |
|---|---|---|
| Males | – maxillary palpi long, equal to proboscis & clubbed<br>– proboscis straight<br>– palpi & proboscis in same line<br>– does not bite | – maxillary palpi short<br>– proboscis slightly curved downward<br>– palpi & proboscis not in one line<br>– does not bite |
| Females | – maxillary palpi long, equal to proboscis and clubbed<br>– proboscis straight & slender<br>– palpi & proboscis in same straight line<br>– adapted for piercing & sucking | – maxillary palpi short<br>– proboscis slightly curved downward<br>– palpi & proboscis not in one line<br>– adapted for piercing & sucking |



Habits: ① Feeding habits: the males never bite: they subsist on plant juices. The females are hematophagous, they require blood meal once in 2 to 3 days for the development of eggs. Some species are anthrophilic (prefer human blood) & some are zoophilic (prefer animal blood).

② Resting habits: some species rest indoors (endophilia) & some rest outdoors (exophilia). The indoor resting places are dark corners of houses, upper parts of walls, behind pictures & under furniture. The outdoor resting places are vegetation, shrubs, tree holes, cattle sheds & wells.

Disease/s Transmitted:

1) Anopheles: malaria, Filaria (not in India)

2) Culex: Bancroftian filariasis, Japanese encephalitis, westnile fever, viral arthritis

3) Aedes: Dengue fever, chikungunya fever, Rift valley fever Filaria (not in India), Yellow fever (not in India)

Control Measures:

| 1) ANTI-LARVAL | 2) ANTI-ADULT | 3) PROTECTION AIG MOSQUITO BITES |
|---|---|---|
| a) Environmental control | a) Residual sprays | a) mosquito net |
| b) Chemical control | b) Space sprays | b) Screening |
| c) Biological control | c) Genetic control | c) Repellants |

# ANOPHELES MOSQUITO

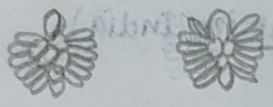
Life History (With diagrams):

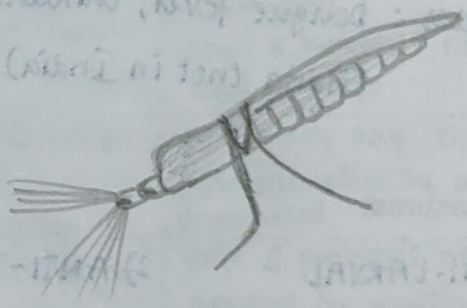
* stages in life cycle of Anopheles

- Eggs : eggs are laid singly, boat shaped, possess lateral floats
- Larvae: floats horizontally in water & have no siphon tube at the tip of its abdomen. Palmate hairs are present on abdominal segments.
- Pupae : siphon tube is broad & short
- Adult : wings spotted, palpi long in both sexes when at rest, inclined at an angle to surface.

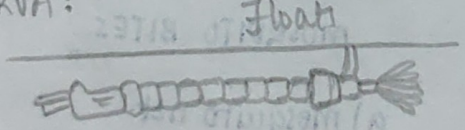
* Breeding place : clean water
* Biting time: evening & night
* Disease transmitted : malaria, filariae (not in India)

EGG:

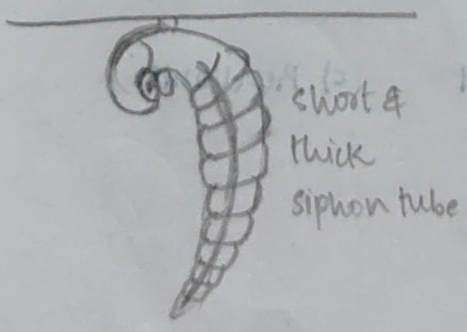


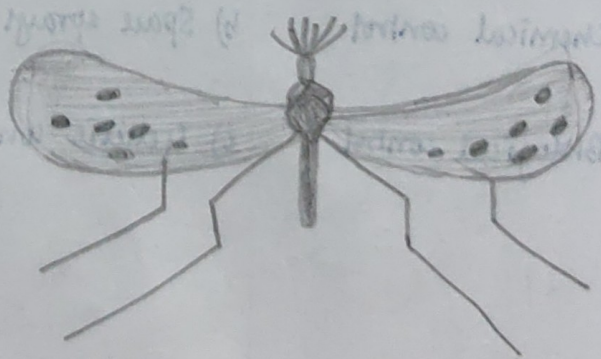



LARVA:




PUPA:



Habits: 1) Feeding habits: Anthrophilic or zoophilic
females require a blood meal for development of eggs

2) Time of biting: Evening or early night

3) Resting habits: dark corners, indoors (endophilia), outdoors (exophilia)

4) Breeding habits: prefer clean water

5) Hibernation: Severe winters are tided over

Disease/s Transmitted: 1) Malaria

2) Filaria (not in India)

Control Measures: 1) ANTI-LARVAL MEASURES

a) Environmental control - breeding places should be abolished by appropriate engineering measures such as filling & drainage

b) Chemical control - commonly used larvicides are Mineral oils, Paris green & synthetic insectisides

c) Biological control

2) ANTI-ADULT MEASURES - a) Residual sprays b) Space sprays
c) Residual insecticides General control methods

3) PROTECTION AGAINST MOSQUITO BITES

# CULEX MOSQUITO

Life History (with diagram):

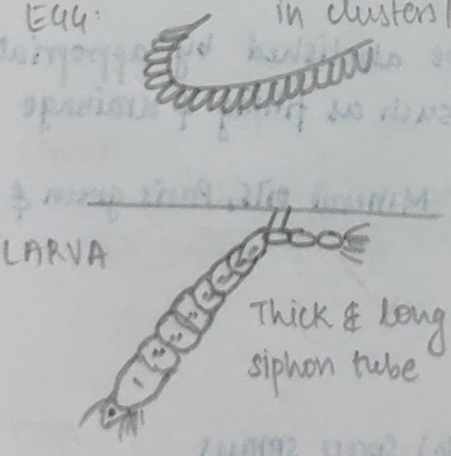
* stages in life cycle of culex mosquito

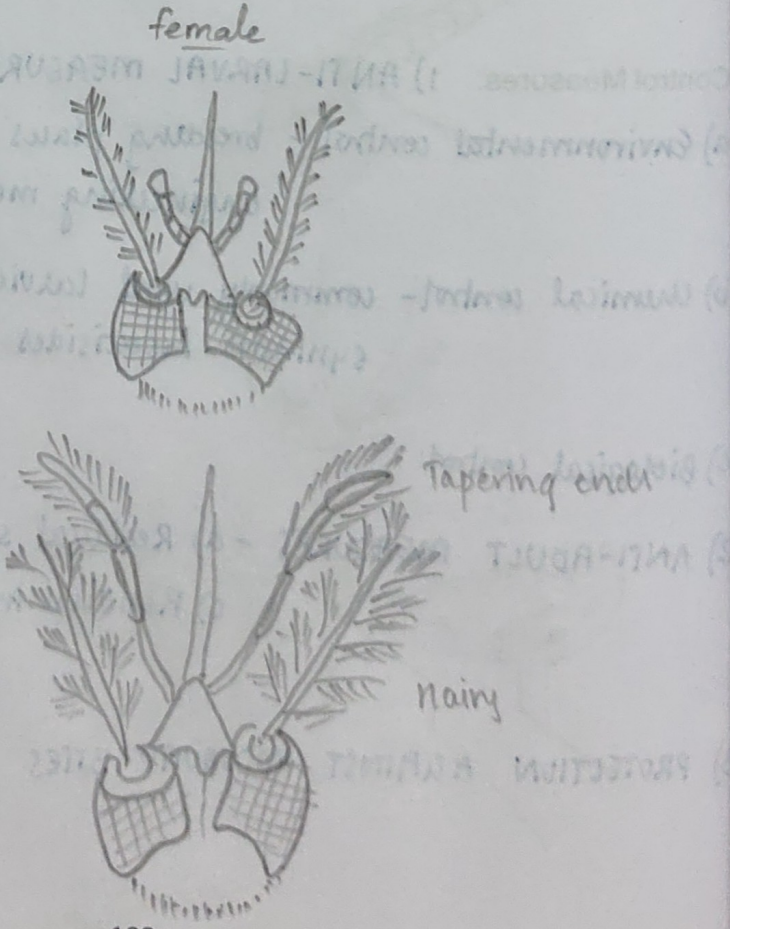
• Eggs :- culex lays egg in smaller cluster on rafts
- do not possess lateral floats
- each raft : 100-250 eggs
- eggs are oval shaped not provided with lateral floats

• Larvae:- suspended, head downwards at an angle to surface of water
- siphon tube present, no palmate hair
- siphon tube in the 8th abdominal segment

• Pupae :- siphon tube is long & narrow

• Adult :- when at rest, the body exhibits a hunch back
- wings are unspotted
- palpi short in female



Habits: 1) Feeding habits : males never bite, they feed on plant juice
females are hematophagous, they require blood meal
once 2-3 days for development of eggs

2) Time of biting: early night & evening

3) Breeding habit: profusely in dirty water collection, stagnant septic tanks, burrow pits

Disease/s Transmitted: 1) Bancroftian filariasis
2) Japanese encephalitis
3) West nile fever
4) viral arthritis

Control Measures: 1) ANTI LARVAL MEASURES
a) Environmental control : abolition of domestic & peridomestic sources of breeding such as cesspools & open ditches. Adequate collection, removal and disposal of sewage & waste water
b) Chemical control:
c) Biological control

2) ANTI ADULT MEASURES : a) Residual sprays b) Space sprays c) Genetic control methods

3) PROTECTION AGAINST MOSQUITOE BITES

# AEDES MOSQUITO

Life History (with diagram):

* stage in life cycle of Aedes mosquito

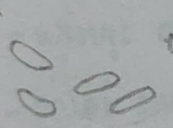
- Eggs : eggs laid singly
  eggs are cigar shaped & do not possess lateral floats

- Larvae :- suspended in water with their head downward
  - have siphon tube which is situated on 8th abdominal segment
  - no palmate hairs

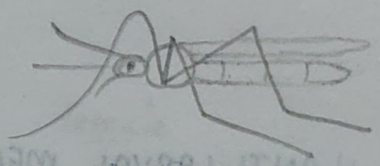
- pupae : siphon tube is long & narrow

- Adult : - wings unspotted
  - palpi short in female
  - when at rest, the body exhibits a hunch back
  - has white stripes on black body
  - legs are striped or banded, hence called "tiger mosquito"

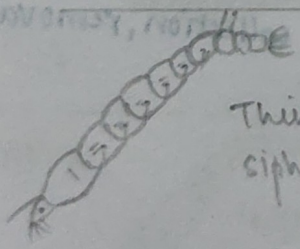
EGG:



cigar shaped
singly placed

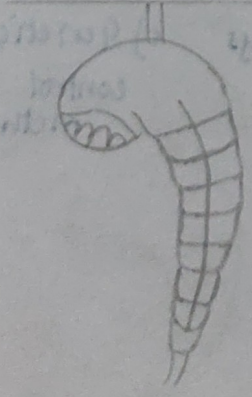


LARVA: Bottom feeders



Thin & short siphon tube

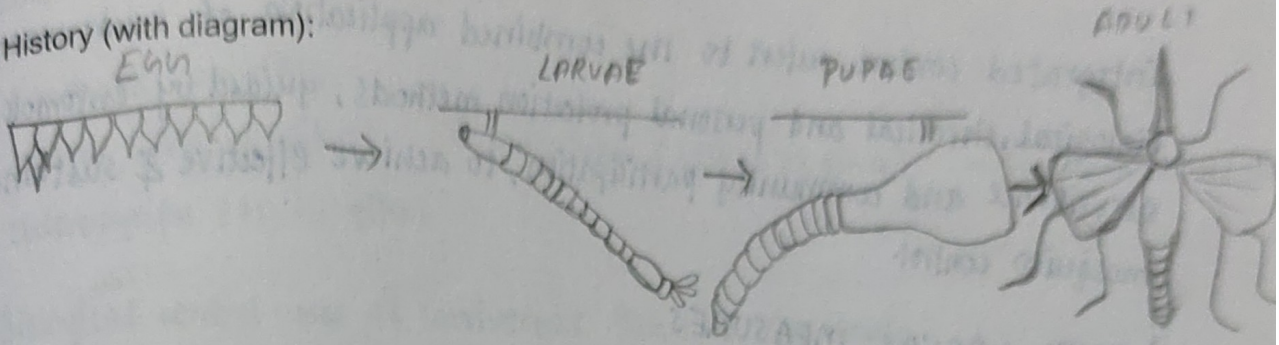
PUPA:



Thin & long siphon tube

# MANSONOIDES MOSQUITO

Life History (with diagram):




Habits: 1) Resting habit : Endophilic & Exophilic

2) Feeding habit : Zoophilic but also bites humans

3) Time of biting : bites at night

4) Breeding habit : breeds in stagnant water with aquatic vegetation
larvae & pupae attach to plant roots for oxygen

Disease/s Transmitted: 1) Malayan (Brugian) filariasis

2) chikungunya fever

Control Measures: 1) ANTI-LARVAL MEASURES

a) Environmental control - the aquatic plants (Pistia stratiotes & water hyacinth) to which the larvae attach themselves should be removed or destroyed by herbicides.

b) Chemical control - commonly used → Mineral oils, Paris green, Synthetic insecticide

c) Biological control

2) ANTI ADULT MEASURES - a) Residual sprays b) Genetic control method
c) Space sprays

3) PROTECTION AGAINST MOSQUITO BITES

# INTEGRATED CONTROL MEASURE

## (MOSQUITO)

Integrated control refers to the combined application of environmental, biological, chemical and personal protection methods, guided by entomological surveillance and community participation, to achieve effective & sustainable mosquito control.

1) ANTI-LARVAL MEASURES

a) Environmental Control: most important step in reducing the number of mosquitoes is to eliminate their breeding places. This is known as source reduction. comprises of minor engineering methods -

- filling, levelling & drainage of breeding places
- water management such as intermittent irrigation

* Species specific environmental control methods -

i) Culex: abolition of domestic & peridomestic sources of breeding such as cesspools and open ditches. Adequate collection, removal and disposal of sewage & waste water

ii) Aedes: getting rid of water holding containers such as discarded tins, empty pots, broken bottles, coconut shells & similar other artificial collections of water

iii) Anopheles: breeding places should be abolished by appropriate engineering measures such as filling & drainage.

iv) Mansonia: the aquatic plants (Pistia stratiotes & water hyacinth) to which the larvae attach themselves should be removed or destroyed by herbicides.

b) Chemical control

i) mineral oils - eg. diesel oil, fuel oil, Kerosene

- form film on water → block air → kill larvae/pupae
- dose: 40-90 L/ha, weekly
- disadvantage: water unfit for drinking, kills fish

ii) Paris green
- stomach poison [illegible]rae (mainly Anopheles as they are surface feeders)
- dose : 1Kg/ha
- does not harm fish/humans at this dose

iii) Synthetic larvicides
- Abate (56-112 g/ha) - Malathion (224-672 g/ha) - Fenthion (22-112 g/ha)
- chloropyrifos (11-16 g/ha)

c) Biological control - use of larvivorous fish like Gambusia

2) ANTI ADULT MEASURES

a) Residual sprays - eg. DDT, Lindane, Malathion, Propoxur

b) Space sprays - eg. Pyrethrum extract, Residual insecticides

c) Genetic control Methods - eg. sterile male technique
cytoplasmic incompatibility
chromosomal translocations
sex distortion

3) PROTECTION AGAINST MOSQUITO BITES

a) Mosquito net: offers protection against mosquito bites during sleep. material should be white - for easy detection of mosquito. The best pattern would be rectangular.

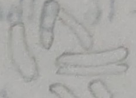
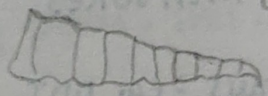
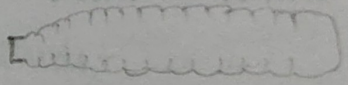
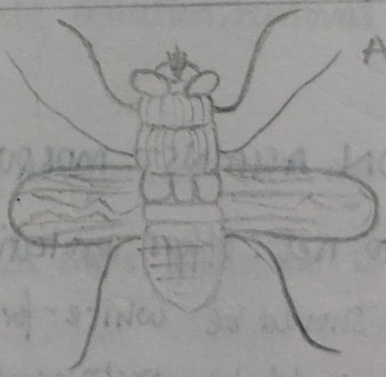
b) Screening: of buildings with copper or bronze gauze having 16 meshes to the inch is recommended. Aperture should not be larger than 0.0475 inch.

c) Repellants: Diethyl toluamide (deet) is an all purpose repellant, effective against Culex fatigans for 18 to 20 hours. Others used are indalone, dimethyl phthalate, dimethyl carbate, ethyl hexane diol etc.

PR-2 FLIES DATE:

# HOUSE FLY

Life History (with diagram):

| | |
|---|---|
| EGG: laid in decaying organic matter; 120-150 at a time, 600-900 lifetime 1mm, pearly white; hatch in 8-24 hrs |  EGG |
| LARVA (MAGGOT):<br>- 1-2mm → 12mm, white, footless<br>- Avoid light, feed actively, 2 moults<br>- Duration 2-7 days, longer in cold |  LARVA |
| PUPA:<br>- Dark brown, barrel-shaped, ~1/4 inch<br>- Duration 3-6 days (longer in winter) |  PUPA |
| ADULT:<br>- Egg → adult: 5-6 days (summer); 8-20 days otherwise<br>- Life span: ~15 days (summer); ~25 days (winter) |  ADULT |

Habits: 1) Feeding habits:- does not bite. It cannot eat solid foods; it vomits on solid food to make a solution of it & sucks in a liquid state. Adult flies are found on sputum, feces, discharge from wound, open sores

2) Restlessness:- fly is a restless insect & moves back & forth between food & filth

3) Vomit drop:- fly vomits frequently. The vomit drop is often a culture of disease agent

4) Defecation:- defecates constantly all day

5) Resting habits:- rest on vertical surfaces & hanging objects

6) Dispersal:- upto 4 miles

Disease/s Transmitted:

1) Typhoid & paratyphoid
2) Diarrhoea & dysenteries
3) Cholera & Gastroenteritis
4) Amoebiasis & Helminthic infections
5) Poliomyelitis
6) Conjuctivitis, trachoma
7) Anthrax, Yaws

Control Measures: a) Environmental control - to eliminate breeding places
- covered bins; segregate waste
- regular refuse disposal (incineration / compost / landfill)
- stop open defecation & hygenic disposal of animal excreta

b) Personal hygiene
- clean Kitchen, cover food
- wash hands before food & after toilet
- trim & clean nails

c) Insecticidal control
- Residual sprayer - space sprays - Larvicides - Baits - Impregnated ribbons

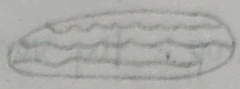
d) Fly papers

e) Protection

# SAND FLY

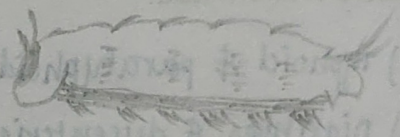
Life History (with diagram):

EGG:
- laid in damp, dark areas near cattle/poultry shed
- large, torpedo-shaped, wavy lines
- hatch in ~7 days



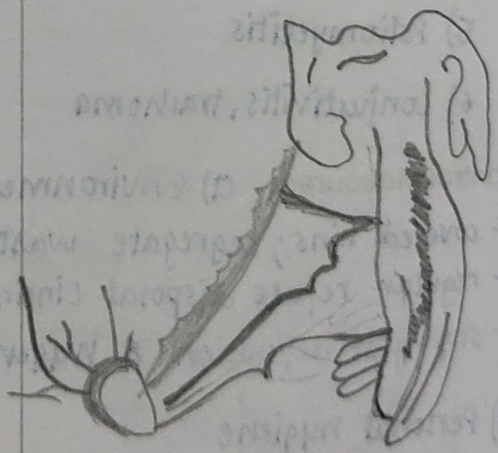
EGG

LARVA:
- hairy maggots with head, thorax, abdomen
- 4 larval instars
- last segment: 2 pairs long stout hairs
- feed on decaying organic matter, pupate in ~2 weeks



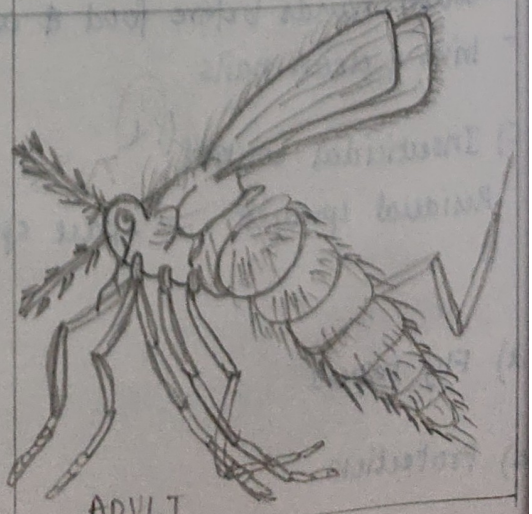
LARVA

PUPA:
- 3mm, clubshaped, head & neck curved backward
- duration ~ 1 week



PUPA

ADULT:
- lives ~2 weeks, nocturnal, painful bite
- hides in cracks, walls, trees, active at night
- female needs blood every 3-4 days for eggs
- hops, poor flier; stays within ~50 yards of breeding site



ADULT

Habits: 1) Feeding habits: nocturnal biters (only females bite)

2) Breeding habits: organic matter, cracks, burrows

3) Resting habits: indoors & outdoors in dark corners, tree holes

Disease/s Transmitted: 1) Kala-azar

2) oriental sore

3) sandfly fever

Control Measures: 1) Insecticides

- By spraying insecticides like DDT & Lindane

) Source reduction

- removal of shrubs & vegetation within 50 yards of human dwellings
- filling up cracks & crevices in walls & floors
- location of cattle sheds & poultry at a fair distance from human habitation

) Personal Protection

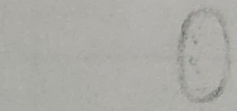
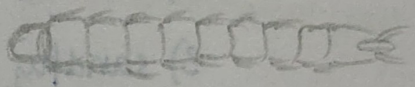
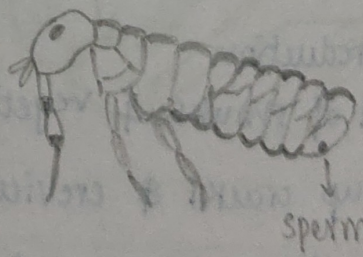
- sandfly net impregnated with permethrin can be used. The net should have 45 mesh/inch
- not walking in barefoot & using gumboots

# FLEAS

# RAT FLY

DATE:

Life History (with diagram):

| | |
|---|---|
| EGG:<br>- 0·5mm, white, ovoid<br>- laid among host hair/nest (2-6 at a time)<br>- 300-400 total, hatch in 2-7days |  <br>EGG |
| LARVA:<br>- whitish, legless, hairy, caterpillar-like<br>- in dust/debris near host nest<br>- feed on organic matter & adult flea fecal matter<br>- 3 instars, last spins cocoon |  <br>LARVA |
| PUPA:<br>- inside cocoon<br>- last 1-2 weeks |  <br>PUPA |
| ADULT:<br>- life cycle ~ 3 weeks<br>- adult life span ~ 30 days<br>- infested fleas may survive upto 1 year |  <br>spermatheca<br>ADULT |

Habits: Feeding habits: both sexes bite & suck blood, they feed at frequent intervals

Resting habits: found on their hosts & in the nests, burrows of their hosts. They are also found in the dwellings, on the ground, in cracks & crevices and under carpet

cannot fly, but can make vertical jumps upto 4 inches & horizontal jumps upto 6 inches

Disease/s Transmitted: 1) Bubonic plague
2) Endemic typhus
3) Chiggerosis
4) Hymenolepis diminuta

Control Measures: 1) Insecticides
- 10% DDT dust - dust rat runs & burrows - spray floors & walls

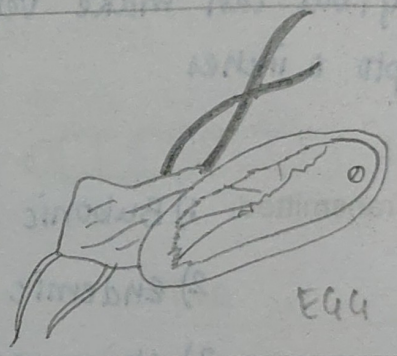
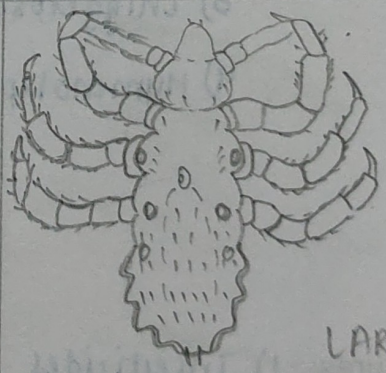
2) Repellants
- DEET, benzyl benzoate

3) Rodent control
- sanitation : proper waste & food storage
- Rodenticide : ◦ single dose → zinc phosphide ◦ multiple dose → warfarin
- Fumigation : cyanogas
- Trapping

# LICE FLY

## HEAD LOUSE, BODY LOUSE, CRAB/PUBLIC LOUSE

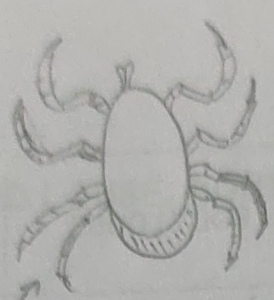
Life History (with diagram):

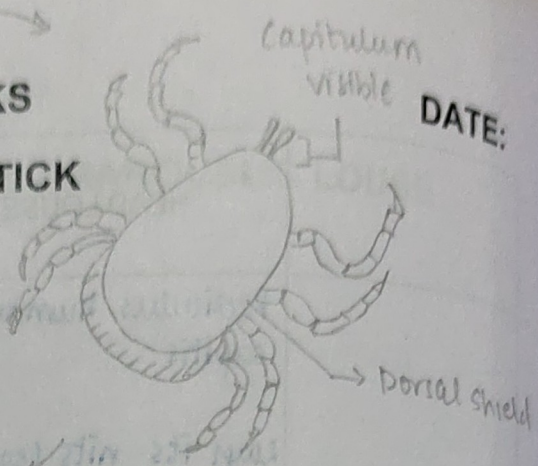
| | |
|---|---|
| Eggs: eggs are laid singly in groups, firmly attached to hair or seams of clothing. Eggs are small, white, ovoid bodies, pointed at one end & truncated & pitted at the other end. A female lays upto 300 eggs at the rate of 4 to 9 eggs a day. |   |
| Larva: The larva looks very much like an adult, except for its smaller size. It feeds on the host & develops into an adult after passing through 3 moults. The larval stage may take 10-15 days |   |
| Adult: The entire life cycle from the laying of an egg to the appearance of the adult louse takes about 15 to 17 days. Life span of adult = 30 to 50 days. |   |

| | HEAD LOUSE | BODY LOUSE | CRAB/PUBIC LOUSE |
|---|---|---|---|
| Habits | Pediculus humanus capitis<br><br>Lays its nits (egg) on the hair of head & lives on scalp | Pediculus humanus corporis<br><br>Lays eggs in bedding / clothing around base of neck or lives on beds | Phirus pubis<br><br>Lays eggs in hair of pubic area |
| Disease/s Transmitted/ Health Problems Caused | 1) Pediculosis<br>2) Epidemic typhus<br>3) Relapsing fever<br>4) Vagabond disease | 1) Pediculosis<br>2) Epidemic typhus<br>3) Relapsing fever<br>4) Vagabond disease | 1) Pediculosis<br>2) Epidemic typhus<br>3) Relapsing fever<br>4) Vagabond disease |
| Control Measures | 1) Insecticidal control<br>- 5% malathion lotion<br>- 5% carbaryl dust<br>2) Personal hygiene<br>- regular hair washing & combing<br>- avoid sharing combs | 1) Insecticidal control<br>- 1% malathion powder apply to inner surface of clothes<br>2) Personal hygiene<br>- daily bath, clean clothes<br>- health education | 1) Insecticidal control<br>- 0.5% malathion or 1% permethrin lotion<br>2) Personal hygiene<br>- shave affected hair<br>- wash clothes |

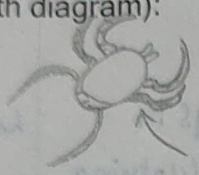
PR-3 **TICKS** DATE:

**HARD TICK**






Life History (with diagram):



Female Tick lays egg

Habits: Feeding habit: cannot stand starvation, feed day & night

Location: always found on their hosts.

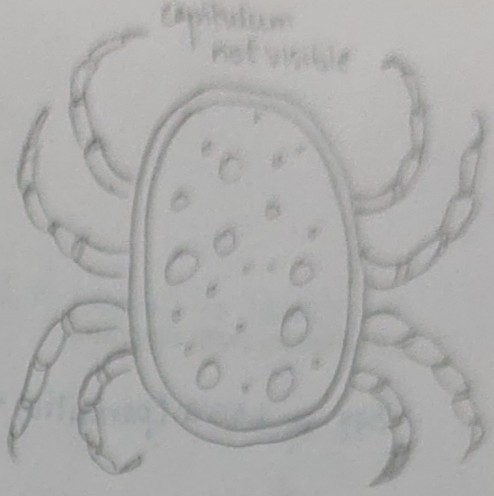
Disease/s Transmitted: 1) Kyasanur Forest Disease 7) Viral fever
2) Tick typhus
3) Viral encephalitis
4) Tularemia
5) Tick paralysis
6) Human babesiosis

Control Measures: a) Insecticidal control
- 5% DDT, 2.5% chlordane, dieldrin, lindane
- apply 1-2 lbs/acre
- treat animals with insecticidal sprays

b) Environmental control
- Seal cracks & crevices near buildings

c) Personal protection
- use clothing impregnated with repellants (DEET, indalone)
- workers should check & remove ticks promptly

## SOFT TICKS




Life History (with diagram):

Habits: Feeding habits: can stand starvation for a year or more

Location: hides in cracks & crevices in daytime & emerge at night to feed on the host

Disease/s Transmitted: 1) Kyasanur Forest Disease
2) Q fever
3) Relapsing fever

Control Measures: a) Insecticidal control
- 5% DDT, 2.5% chlordane, dieldrin, lindane
- apply 1-2 lbs/ acre
- treat animals with insecticidal sprays

b) Environmental control
- seal cracks & crevices near buildings

c) Personal Protection
- use clothing impregnated with repellants
- workers should check & remove ticks promptly

# MITES

## TROMBICULID MITE

Life History (with diagram):

Egg → Larva (parasitic) → Nymph (free living) → Adult (free living)

Habits:

Feeding habits: larvae attacks vertebrae host, when gauged with blood drops down

larval stage → they attach to animals & humans causing itching

Resting habits: like arthropods, live in forests, grasslands & vegetation of low damps

Disease/s Transmitted: 1) scrub typhus

2) Rickettsial pox

Control Measures: a) Insecticidal control

- 5% DDT, Chlordane, Dieldrin, Lindane, Malathion
- either dusting or spray formulation

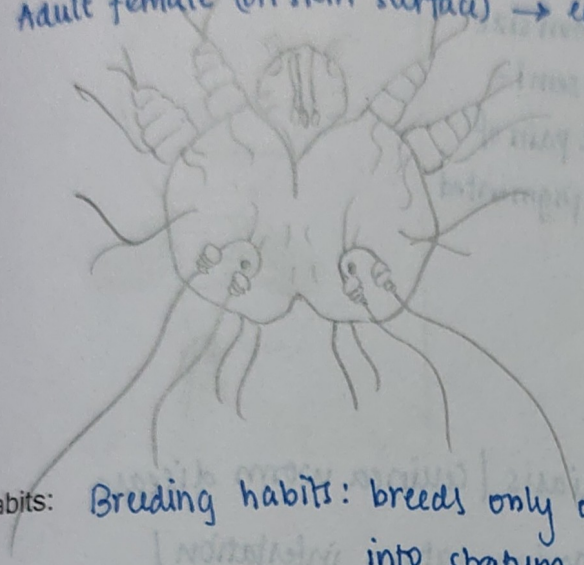
b) Environmental control

- cracks & crevices in grounds to be sealed; particularly near buildings

# ITCH Mites

Life History (with diagram):

Adult female (on skin surface) → eggs laid in burrow → larvae → Nymph → Adults



Habits: Breeding habits: breeds only on human skin, female burrows into stratum corneum

Feeding habit: sucks tissue fluids & lymph from skin

Resting habit: lives & rest

Health Problems Caused: 1) Scabies

Control Measures: * control of scabies: to treat all members of the affected household simultaneously whether or not they appear to be infected.

Effective sarcopticide: Benzyl benzoate - 25%.

Lindane - 0.5 to 1%.

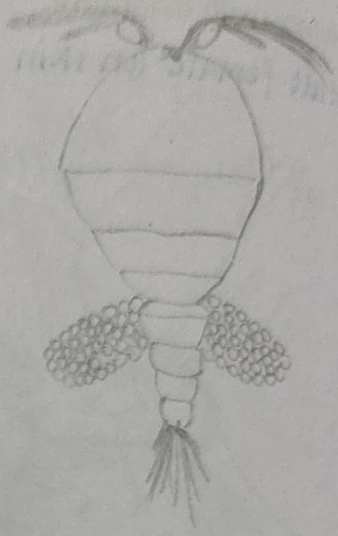
GABA - 5%.

Tetmosol - 5%.

Sulphur ointment - 2.5 to 10%

# CYCLOPS

General Description:
tiny arthropod not more than 1mm size in length. It has a pear shaped semi-transparent body, a forked tail, 2 pairs of antennae, 5 pairs leg & a small pigmented eye



Diseases Transmitted: 1) Dracunculiasis / Guinea worm disease
2) Diphyllobothrium latum infestation / Fish tape worm disease

Control Measures: 1) Physical control
- straining water through fine control
- boiling (cyclops killed at 60°c)

2) Chemical
- Chlorine 5ppm (also kills Guinea worm larvae, dechlorinate excess)
- Lime 4g/gallon
- Abate (temephos) 1mg/L

3) Biological
- Barbel & Gambusia fish eat cyclops

4) Environmental
- abolish step wells, provide sanitary wells
- piped water provision