Medical Entomology
Code: ش404

Supervised by

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رؤية كلية العلوم

التميز في تعليم العلوم الاساسية والبحث العلمي للمساهمة في التنمية المستدامة

رسالة كلية العلوم

تقديم تعليم مميز في مجالات العلوم الاساسية وانتاج بحوث تعليمية تطبيقية للمساهمة في التنمية المستدامة من خلال اعداد خريجين متميزين طبقاً للمعايير الاكاديمية القومية وتطوير مهارات وقدرات الموارد البشرية وتوفير خدمات مجتمعية وبيئية تلبي طموحات مجتمع جنوب الوادي وبناء الشراكات المجتمعية الفاعلة .

رؤية القسم

خريجون وباحثون متميزون علمياً وبحثياً في دراسة ضرر ونفع الكائنات الحيوانية خدمة للمجتمع وتنمية للبيئة

رسالة القسم

يسعى قسم علم الحيوان والحشرات بكلية العلوم جامعة جنوب الوادي من خلال ما يقدمة من برامج تعليمية باستخدام الوسائل العلمية والتعليمية المتطورة والتي تكشف عن المزيد من ضرر ونفع الكائنات الحية وباحثين وخريجون متميزين علمياً وبحثياً ينتفع بهم المجتمع وترتقي بهم الامة .

Contents

Introduction

What is meant by Medical Entomology?

Medical entomology is : The science that study insects which cause disease transmission for human

Why we study medical entomology ?

Due to its medical importance as it affect the health of man by any of the following methods :

1- Direct agent of disease or discomfort :

Entomophobia : Fear of insects

Envenomization : inoculation of poison

Pest of man : ectoparasite causing nuisance

Harm or injury : irritation of skin causing urticaria

2- Disease transmission :

Mechanical :

As the insect transmit the disease pathogens frompolluted source to human as house fly which transmit **typhus** and **chollera**

Biological :

The insect is an obligatory vector or natural vector forming an integral part of the life cycle of the parasite or pathogen

Biological may be :

Propagative : multiplication of the pathogen without developmental change
e.g. **Plague** (flea) , yellow fever (*Aedes aegypti*)
Cyclopropagative : multiplication and developmental change of the pathogen
e.g. Malaria (*Anopheles*) , Trypanosomiasis (tsetse fly), Leishmaniasis(sandfly)

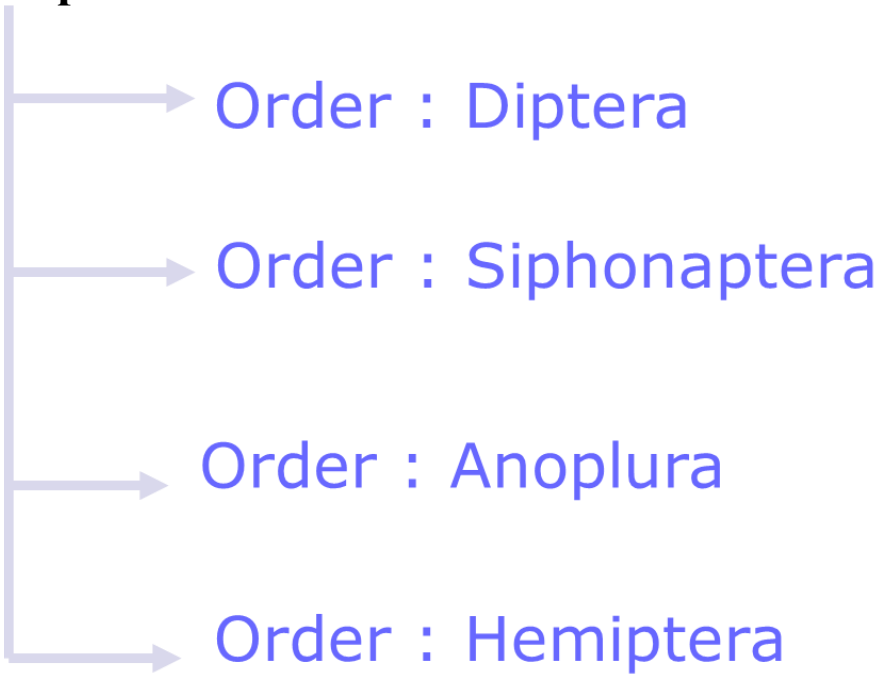
Cyclodevelopmental : developmental change without multiplication
e.g. Filariasis (*Culex*)

ORGANISMS TRANSPORTED :
Protozoa - malaria, sleeping sickness, Chagas' disease, Leishmania.

Arboviruses - myxomatosis, equine encephalitis, yellow fever, dengue, blue tongue virus.
Rickettsias - endemic typhus, murine typhus, scub typhus.
Bacteria - plague.
Nematodes - elephantiasis (filariases), river blindness.
Factors affecting disease transmission :
Vector distribution (in turn dependant upon climate, habitat etc).
Vector abundance (affected by weather, predators, food etc).

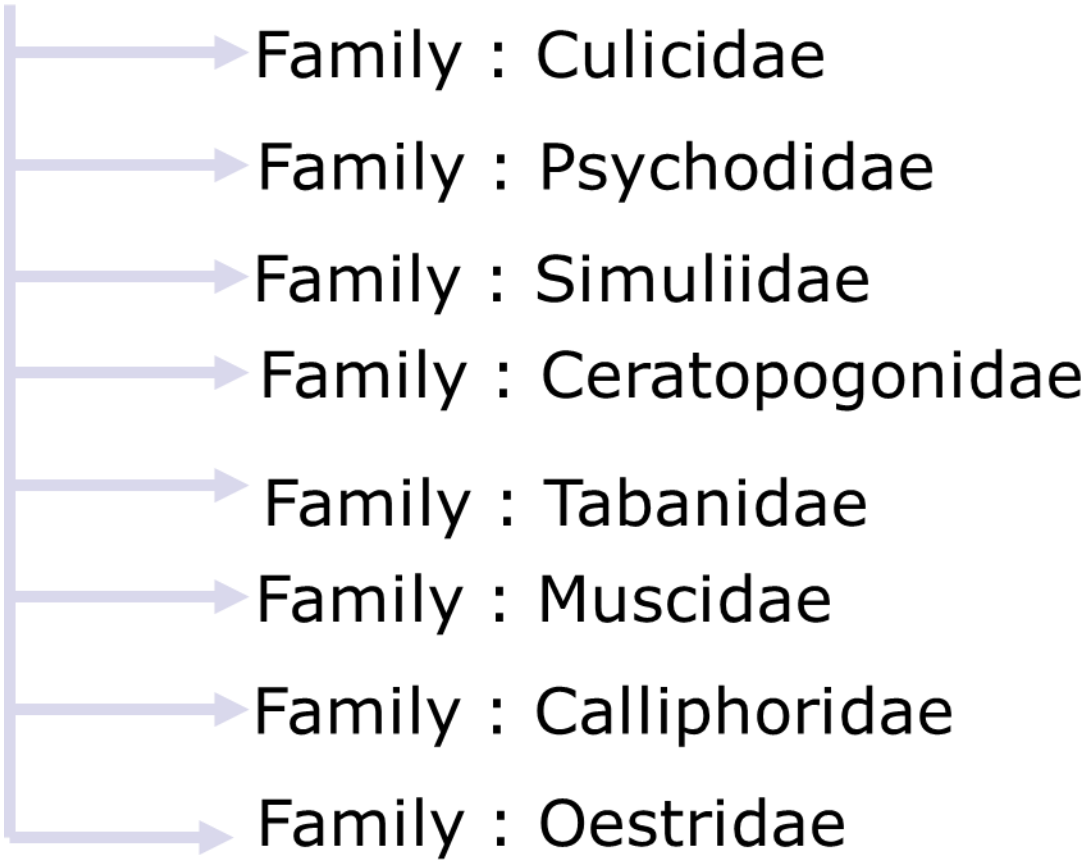
Life expectancy of vector (long life gives more time for transmission).
Preference of vector to humans (as opposed to alternative hosts).
Feeding rate of vector.
Vector competence (efficiency of transmission).
Population density of host.
Disease carried by insects affect more than 700 million people every year (WHO)

Class insecta is divided into 4 orders of medical importance :



Order: Diptera
(Mosquitoes and flies)

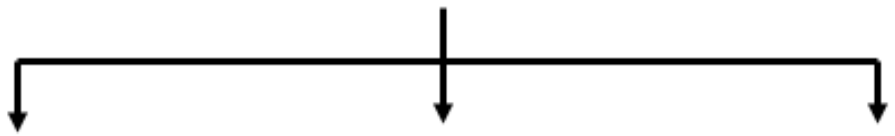
Order : Diptera is divided into 8 families of medical importance :



Family : Culicidae

There are some 3200 species of mosquitoes belonging to 37 genera , all contained in the family Culicidae

This Family is divided into 3 Subfamilies :



Toxorhynchitinae	Anophelinae	Culicinae
	Anopheles sp.	***Culix pipiens*** ***Aedes aegypti***

General Chracters of Family : Culicidae

Size : 5-10 mm

Body is divided into :

Head:globular and carries :

eyes : compound

antenna : long hairy 13 seg.

male(plumose),female(pilose)

mouthparts : piercing and sucking

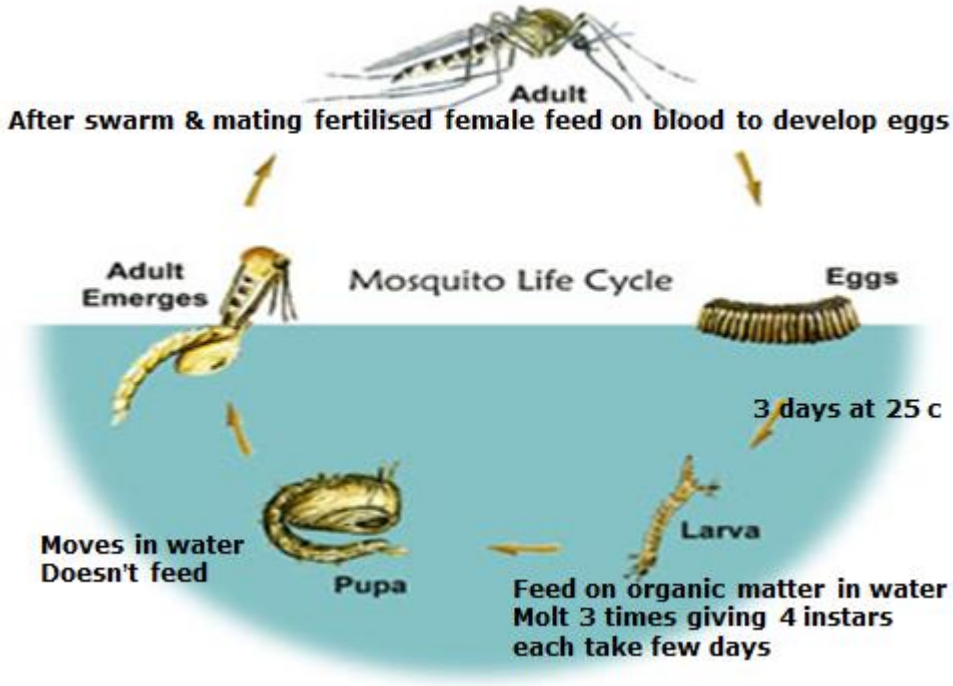
in female , sucking in male

Thorax : divided into pro-,meso-(biggest)and metathorx

legs : very long wings : 1 membranous pair.

Abdomen : long and selender (10 seg.) 8 are seen

external genitals at its posterior end.



Metamorphosis : Complete metamorphosis

Examples :

1- *Culex pipiens* transmit Encephalitis, Riftvalley fever, *Wuchereria bancrofti*

2- *Aedes agypti* transmit Yellow fever, Dengue fever, *Wuchereria bancrofti*

3- *Anopheles sp.* transmit Human malaria, *Wuchereria bancrofti*

Differences between *Anophles,Culex,Aedes aegypti*

Anophles adult :

Colour : Yellowish brown

Resting position : make an angle 45 to the surface

Maxillary palps : as long as the proboscis with clubbed tip in male or slender tip in female

Wings : spotted specially the anterior margin

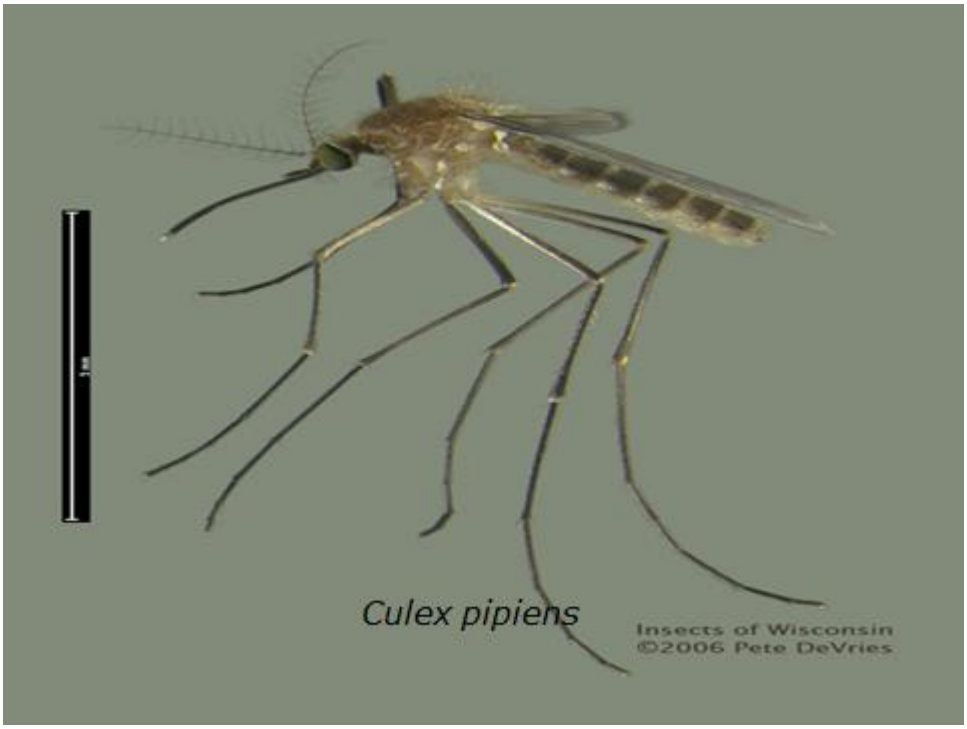
Culex adult :

Colour : yellowish brown

Resting position : Parallel to the surface

Maxillary palps : Longer than the proboscis with slender tip in male or very short in female

Wings : not spotted


Culex pipiens
Insects of Wisconsin
©2006 Pete DeVries


Culex sp.

Aedes adult :

Colour : Black with silvery markings on thorax

Resting position : Parallel to the surface

Maxillary palps : Longer than the proboscis with slender tip in male or very short in female

Wings : not spotted

Eggs : 1 mm - elongate ovoid

Aedes sp.

Blackish
Spindle shaped
Laid singly

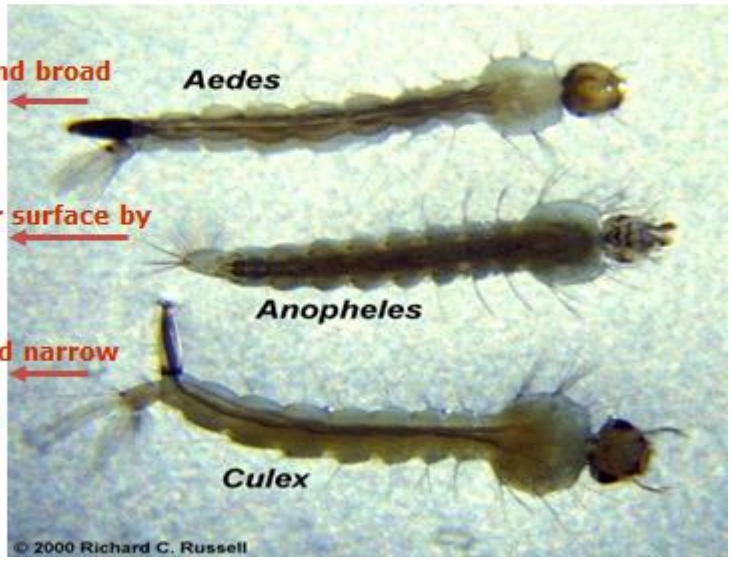
Anopheles sp.

Dark brown
Slipper shaped with air cells on each side
Laid singly

Culex sp.

Yellowish
Ovoid with end broader
Laid in groups(egg raft)

Larvae : aquatic , composed of head , thorax and abdomen




Aedes sp. Larva
2002 Stephen L. Doggett


Culex sp. Larva
© 2002 Stephen L. Dogge


Culex
Aedes
Pupa
© 2000 Richard C. Russ


Anopheles sp. Larva
© 2002 Stephen L. Doggett

Pupae : aquatic - comma shaped composed of cephalothorax and abdomen

Cephalothorax : has 2 trumpets carrying the respiratory spiracles Anopheles (conicaltrumpets), Culex and Aedes (cylindrical trumpets)

abdomen : 9 seg. Ending in 1pair of paddles

MOSQUITO HABITS

The study of the habits or behaviour of the different stages of mosquitoes as influenced by different environmental conditiones (ecology).

Knowing these habits is essential before carrying any control measure directed towards mosquitoes.

The egg:

Many mosquitoes, such as species of *Anopheles, Culex* lay their eggs directly on the water surface.

None of the eggs of these mosquitoes can survive desiccation and if they become dry they die.

Other mosquitoes, such as species of Aedes don't lay their eggs on the water surface but deposit them above the water line on damp substrates. These eggs can withstand desiccation for weeks, months, or even years, and still remain viable and capable of hatching when they are flooded with water.

Aedes eggs may also enter a quiescent state called diapause, and will not hatch until diapause is broken.

The larvae:

Mosquito larval habitats vary from large and permenant collections of water to smaller collections of temporary water. Avarity of natural container habitats provide breeding places.

Many factors influence the life of the larva such as Fauna, Flora, Water movement, Shade or sun, Deep or shallow water, Fresh or polluted water, Temperature.

The pupa:

This stage isn't much affected because it doesn't feed and its duration is relatively short.

The adult:

1) Emergence, swarming, mating and oviposition habits vary.

2) Resting places: exophilic or endophilic.

3) Biting behaviour: by day or night. Anthropophilic or zoophilic.

4) Flight range vary.

5) Longivity: depends on temperature and relative humidity,

6) Hibernation and natural enemies.

Feeding habits

Both male and female mosquitoes are nectar feeders ، but the females of many species are also capable of hematophagy) drinking blood .(Females do not require blood for their own survival ،but they do need supplemental substances such as protein and iron to develop eggs.

In regards to host location ،Carbon Dioxide and organic substances produced from the host ،humidity ،and optical recognition play important roles .In Aedes the search for a host takes place in two phases .First ،the mosquito exhibits a nonspecific searching behavior until

the perception of host stimulants then it follows a targeted approach .

During the heat of the day most mosquitoes rest in a cool place and wait for the evenings .They may still bite if disturbed.

during blood feeding ،they inject saliva into the bodies of their source)s (of blood .Female mosquitoes hunt their blood host by detecting carbon dioxide and octen from a distance.

MEDICAL IMPORTANCE

Culex pipiens

1) *Wuchereria bancrofti* (cause filariasis) .
2) Encephalitis. Many viruses which invade the CNS - disease is characterized

by high fever and headaches.

3) Rift valley fever.

Anopheles sp.

1) Human malaria .
2) *Wuchereria bancrofti* (cause filariasis) .

Aedes agypti

1) Yellow fever. No treatment. Mosquito control is important in preventing this disease.

2) Dengue fever.

3) Wuchereria bancrofti (cause filariasis) .

MOSQUITO CONTROL

Greater efforts have been made to control mosquitoes than any other biting insects.

Control measures can be directed at either the immature aquatic stages or the adults, or at both stages simultaneously.

Control directed at the immature stages

Biological control :

Either the incidence of predators, parasites or pathogens in any habitat must be breatly increased to obtain worthwhile control.

Predators : The most comonly used predators are fish. Species of the genera Gambusia, Poecilia, Sarotherodon and Panchax have been used. Other predators of mosquito larvae and pupae include tadpoles of frogs and toads and various aquatic insect larvae.

Pathogens and Parasites : There are numerous pathogens, such as viruses (e.g. Bacillus thuringiensis and B. Sphaericus), protozoa (e.g. Nosema vavraia, Thelohania) and fungi(e.g.Coelomomyces, Lagenidium) that cause larval mortality. There are also several parasitic nematodes That kill mosquito larvae.

GENETIC CONTROL :

There are several genetic approaches that can be applied to the control of mosquitoes and other vectors. One technique is to colonise large numbers mosquitoes whose genetic make-up has been altered. For example, genetic manipulation and selective rearing can produce mosquitoes that are referactory to infection with human diseases such as malaria. These insects can be realeased into the environment in the hope that they may successfully compete with natural populations and avantually replace them.

Physical (mechanical) control :

1) Filling or drainage in source reduction.

2) Habitat changes to make them unsuitable for mosquito breeding.

Chemical control :

1) Paris green (copper aceto-arsenite), which applied to the water surface as avery fine dust.

2) Oils as diesel oils, fuel oils or kerosene (paraffin), which are sprayed on to water surface blocking larvae tracheae.

3) Residual insecticides as organochlorine insecticides (DDT, HCH and dieldrin) and organophosphate (malathion and chlorpyrifos) and carbamate insecticides.

INTEGRATED CONTROL :

It means combining biological and insecticidal methodes. For example, the introduction of predacious fish to breeding places which are also sprayed with insecticides that have minimum effect on the fish.

Control directed at adults

Personal protection : Houses,hospitals and other buildings can have windows and doors covered with mosquito screening, made of strong plastic or non-corrosive metal (6-8 meshes per centimeter).

Suitable insect reoellents : in the form of oils, creams or aerosols can provide temporary protection.

Residual house-spraying : Spraying the anterior surfaces of walls and roofs of houses and somatimes animal shelters with residual insecticides such as DDT.

Family: Psychodidae

Genus: *Phlebotomus* (Sandfly)

There are some 600 species of phlebtomine sandflies in five genera within the subfamily Phlebtominae of the family Psychodidae.

Distribution: Several species are prevalent in many parts of the world is found throughout Southwest and Central Asia, North Africa, and the Indian subcontinent.

In Egypt, *Phlebotomus papatasi* is the the principal vector for cutaneous leishmaniasis and *Phlebotomus langeroni* the vector of visceral leishmaniasis, In this research we deal with *Phleboyomus babatasi*.

General Characters

1- Adult:

Size: reaching greater than 2-3 millimeter in length**.**

Color: Yellowish, pale (sandy).

Body: covered with hairs,

divided into head, thorax

and abdomen.

1- Head:

Eyes: 2 big conspicuous

black compound eyes.

Antennae: 2 long antennae (16 segments).

Mouth parts:

A- Maxillary palps: 2 maxillary palps (5 segments) bent over the proboscis.

B- Proboscis: Short, piercing and sucking in the female, sucking only in the male.

2- Thorax: humped (humpback) and carries:

A- 3 pairs of legs (long and slender).

B- one pair of oval lanceolate wings attached to the mesothorax.

3-Abdomen:

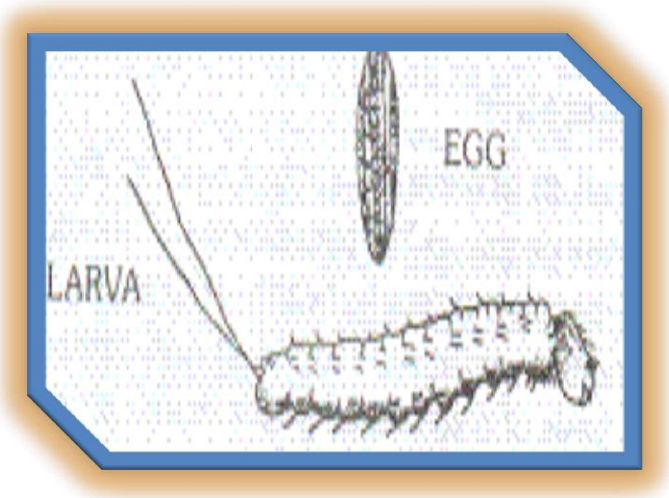
A- Slender in the male with straight outline, ending in a pair of long prominent genital terminalia known as claspers.

Male of sandfly

Female of sandfly

Egg: Elongate ovoid, about 0.5 mm in length, dark and ornamented.

Larva: small, divided into head, thorax (3 segments) and abdomen (9 segments), whitish in color with a black head Capsule, all segments carry serrated hairs, the abdomen has pseudopods, the last abdominal segment carries 4 long, dark caudal bristles.



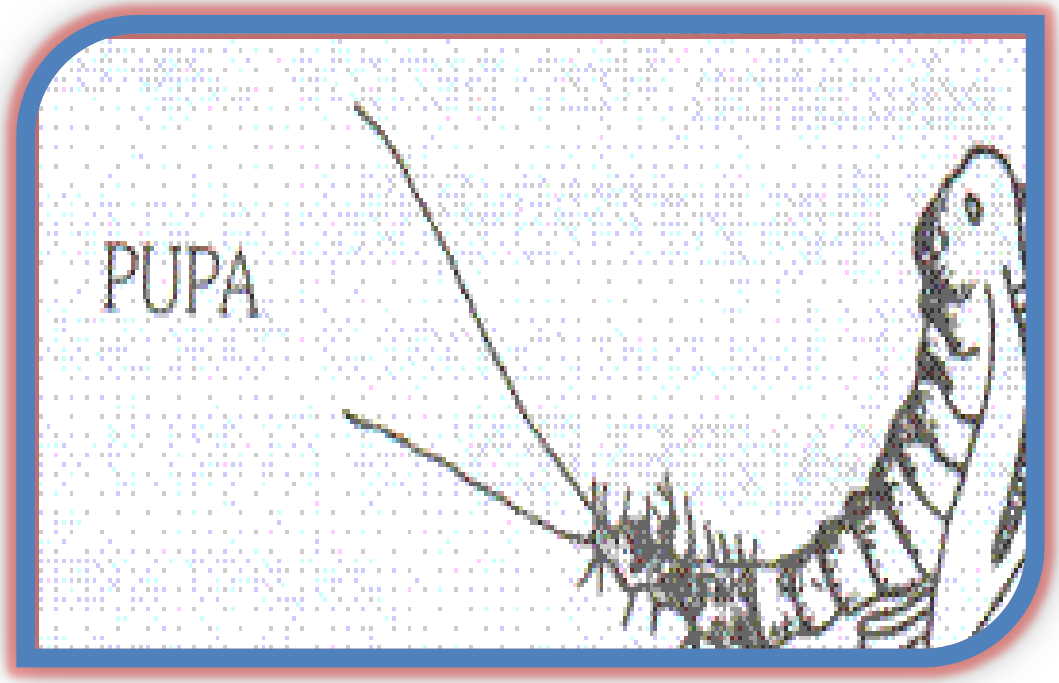
Sandfly larva

Pupa:

- Composed of cephalothorax and abdomen.

- The antenna has a long antennal sheath.

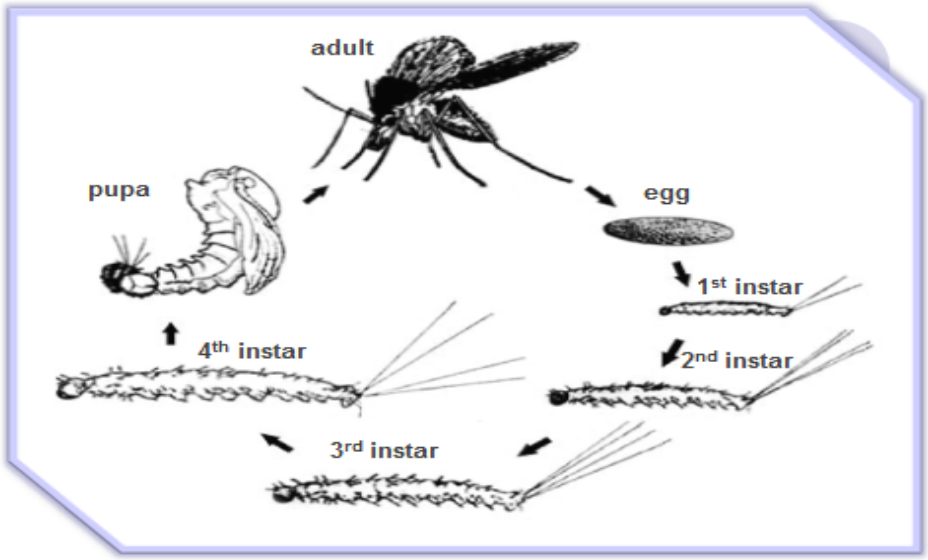
- The larval skin is attached to the posterior end.



Sandfly Pupa

Life cycle:

1- Eggs are laid in batches (4-50) in damp areas, in cracks, crevices or holes, in walls or ground.
2- Eggs hatch in about 10 days.
3- Larvae come out and pass through 4 instars.
4- They become pupae in about 14 days.
5- Adults emerge after about 10 days.



Habits:

1- Sandflies are weak fliers. They tend to (hop) jump.

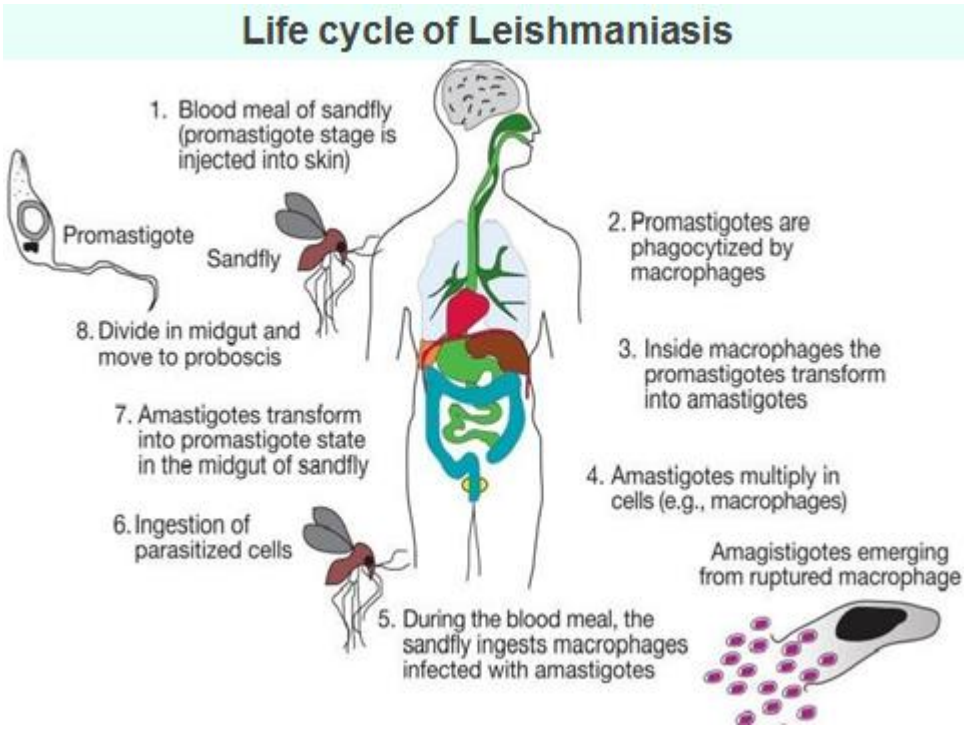
2- Females are nocturnal biters. Their bite is irritating and painful, while their presence is scarcely observed.

Disease transmission:

1- Leishmaniasis: is a disease caused by protozoan parasites that belong to the genus *Leishmania* and is transmitted by the bite of certain species of sand fly (subfamily Phlebotominae).

Parasites are ingested by females with a blood-meal. They develop a flagellum with which they attackh themselves to the gut wall, multiply within the insects's stomach and then migrate to the anterior part of the mid-gut and from there to the oesophagus. After about 4-12

days the infective forms are found in the mouth parts from where they are introduced into a new host during feeding. Leishmania occures in two main forms, *dermal* (*cutaneous*) "*Oriental Sore*" or *"Baghdad Boil"* and *visceral leishmaniasis*.



2- Sandfly fever: sometimes called papatasi fever or 3-day (three-day) fever, this disease is caused by *P. papatasi*. Females become infective 6-10 days after taking an infected blood-meal. It appears that the infected females can lay eggs containing the virus and that these can eventually give rise to infected adults.

3- Orya fever or Carrion's disease or Peruvian verruga (Bartonellosis): It caused by a small rod-like micro-organism named *Bartonella bacilliformis.* Transmission occurs by contamination of the mouth parts.

4- Harrara: Allergic reaction to the bite of sandfly.

:Control of sandflies:

Sandflies are easily controlled because they do not move long distances from the place of their breeding.

1- Filling cracks in walls and ground.
2- Screen and nets (40 meshes per square inch).
3- Insecticides against larvae and adults.
4- Repellents

Family : Muscidae

This Family includes 3 flies of medical importance

1- *Musca domestica*

2- *Stomoxys calcitrans*

3- *Glossina palpalis , Glossina morsitans*

Comparison of the members of Family : Muscidae

	Musca domestica	*Stomoxys calcitrans*	*Glossina palpalis*	*Glossina morsitans*
Common name	House fly	Stable fly	Tsetse fly	
Distribution	Cosmopolitan	Cosmopolitan	West Africa	East Africa

Musca domestica

General chracters :

1- Adult :

Colour : grey

Head :

Antenna : Aristate

Arista : simple hairs on both sides

Proboscis : Sucking – retractile

Maxillary palps : 1 segment – short

Thorax :

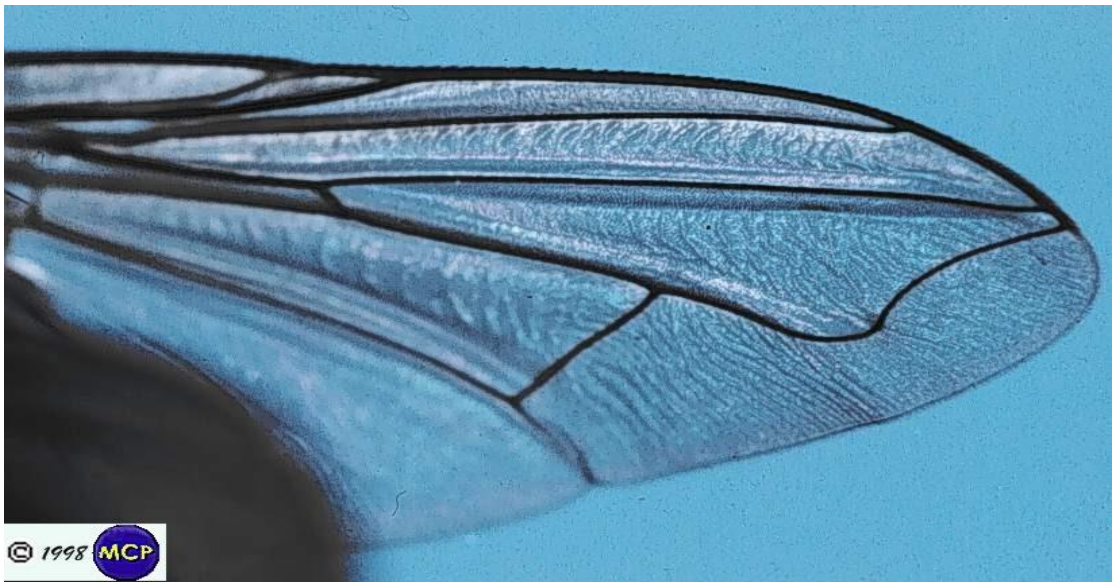
4 longitudinal dark strips

Wings :closed 1st posterior cell (the 4th vein bends making an acute angle to reach the apex close to the 3rd vein)

Abdomen :

4 segments median dark strips

Houseflies can be distinguish from other similar flies because it have vein 4 bending up sharply to join costa close to vein 3



- Each legs end in a pair of claws and fleshy pulvilli.

2- Egg :

Banana –shaped , creamy white , laid in particles

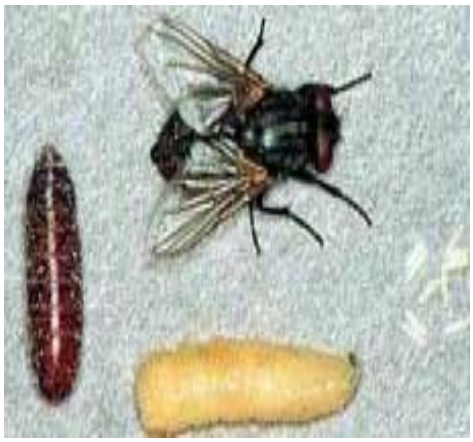
Breeding places : grabage and manure

3- Larva :

Tapering anterior and broad posterior ends

Posterior spiracles : D – shaped

4- Pupa : Barrel – shaped



5- Medical importance :

A- Indirect mechanical transmission of pathogens

B- Accidental mayasis

6 – Control :

A- sanitary disposal of garabage and manure

B- application of insecticides

Houseflies have a worldwide distribution, size about 6-9 mm varying in color from light to dark grey

Feeding habitat

Mouth parts are adapted for sucking fluid and semi fluid foods, when not used they are retracted partially in head capsule, houseflies feed on great verity of substance, specially almost food of man.

The method of feeding differs according to physical states of food , for example milk ; labellae are closely oppressed to food substance which is then sucked through pseudo tracheae, when feeding on semi fluid ;the labellae are completely everted and food is sucked up directly into food channel formed by the apposition of labrum and hypo pharynx .

- If flies feed on solid materials such as sugar the labellae are everted and minute prestomal teeth surrounding the food channel are exposed and scrap away solid foods , then moistens
- Small particles by saliva after which the food sucked
- This later type of feeding is a method which is conductive to spread of variety of pathogens

Life cycle

- Female attracted to decomposing materials for egg laying, female deposit 5-6 such egg batches in its life time, egg hatch after 5-12hours but this period may extend in cool weather
- Most of egg dies after exposure temperature bellow 15

Larva

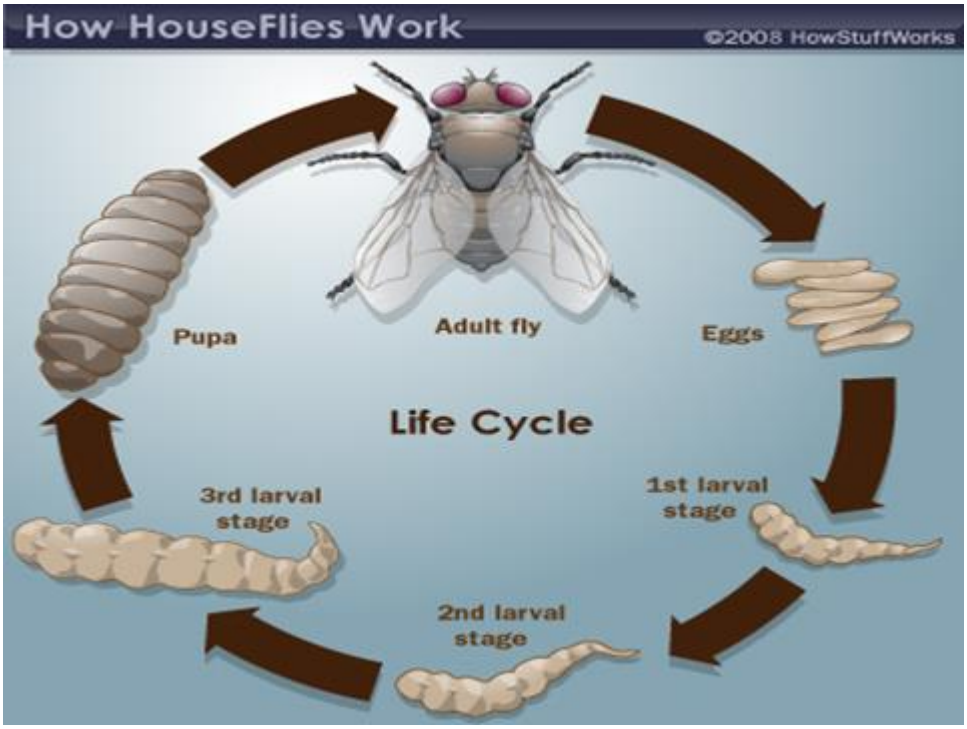
- Creamy white in color, 12segmented, cylindrical, and maggot shaped, feed on fluid food resulting from decomposing of organic materials**,**
- There are 3 larval instars; development may completed within 3-5 days under favorable conditions, 7-10 days under Unfavorable conditions, 24 days in cool weather

Pupa

- The 3rd larval instar migrate from their larval habitat to drier ground , pupation beings with larval

skin contraction ,hardening and turning to dark brown ,then puparium formed .

- Puparial sage talk 3-5 days, 5-7 in cool weather, the adult fly escapes from its Puparial case by pushing off its anterior end, crawling out and flying away



Medical importance

- Houseflies can transmit large number of pathogens, the houseflies contaminated feet, body hairs, mouth parts acting as physical carrier

Adult houseflies can transmit

1. trachoma, infectious hepatitis virus
2. Bacterial disease such as cholera, typhoid, paratyphoid, anthrax.
3. Protozoan parasites such as entamoeba
4. It ay also carries eggs of variety tapeworm's e .g taenia, nematodes e. g ancylostoma, andascaris.

- **Larva**
- Have been recorded in cases of urinogenetal myaises, and more rarely in aural and nasopharyngeal myaises

Housefly's control

Physical control

- Flies can be sometimes be prevented from entering building by screening windows,

- Mount an ultra violet on a wall
- Environmental sanitation
- For example, domestic refuse should be placed in plastic bags, and the opening tightly closed, if house refuse can not collected it should be burnt or covered

Insecticidal control

- Many different types of insecticides have been used to reduce house flies nuisance such as
- 1-aerosols commonly used in homes , that contain of knock-dawn insecticides such as 0.5% dichlorovos or 1-2%pyrthrins with piperonyl butoxide
- 2- Spraying the indoor walls ,doors ,etc. with residual insecticides such as malathion ,which may remain effective 1-2month
- 3-attractant fly baits; in which sugar mixed with an inert carrier such a**s** bran and treated with1-2%insecticides
- 2-lequid baits comprise 10%sugar dissolved in water plus0.2% insecticides

Stomoxys calcitrans

1 – Adult :

Size : 7 – 10 mm
Colour : grey
Head :
Antenna : aristate
Arista : simple hairs on dorsal side only
Proboscis : biting (piercing and sucking) – rigid not retractile
The labium is grooved dorsally to enclose the epipharynx and hypopharynx (all enter the wound during biting)
Maxillary palps : 1 segment – short
Thorax :
4 longitudinal dark strips
Wings : open 1st posterior cell (the 4th vein bends making an obtuse angle to reach the apex away from the 3rd vein
Abdomen :
4 segments – dark round spots
2 – Egg :
Bannana shaped , creamy white , laid in patches
Breading places horse dung

3 – Larva :

Tapering anterior and posterior ends

Posterior sopiracles : triangular

4 – Pupa :

Barrel – shaped

5 – Medical importance :

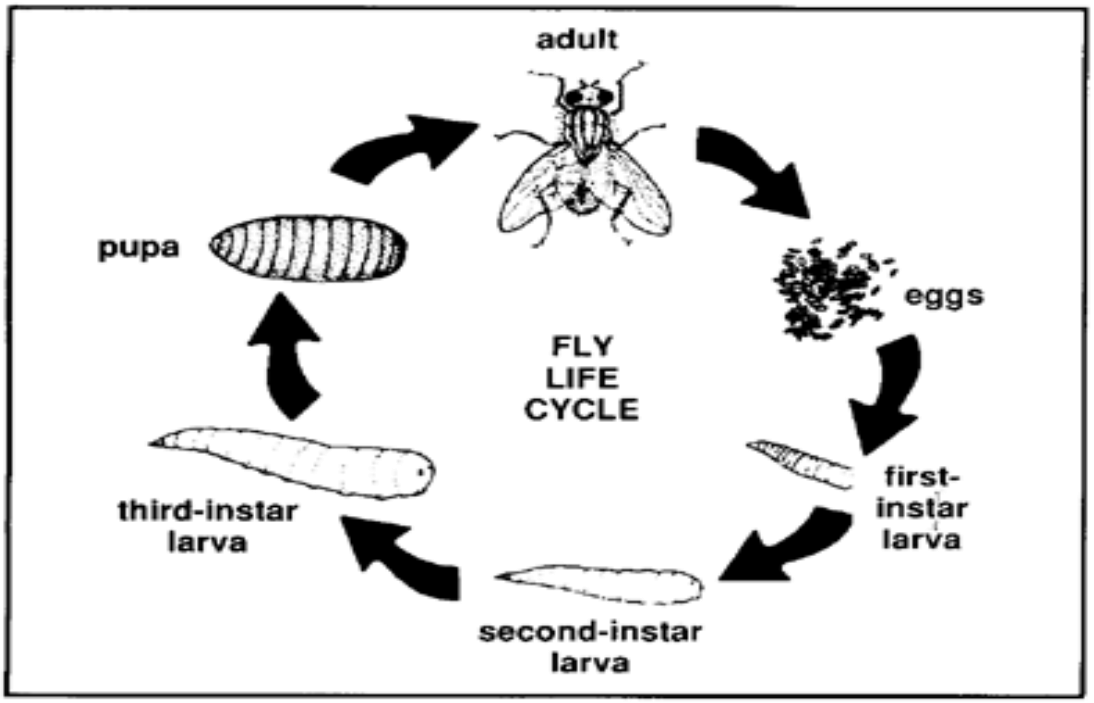
A- Direct mechanical transmission of blood parasites as trypanosomes

6 – Control :

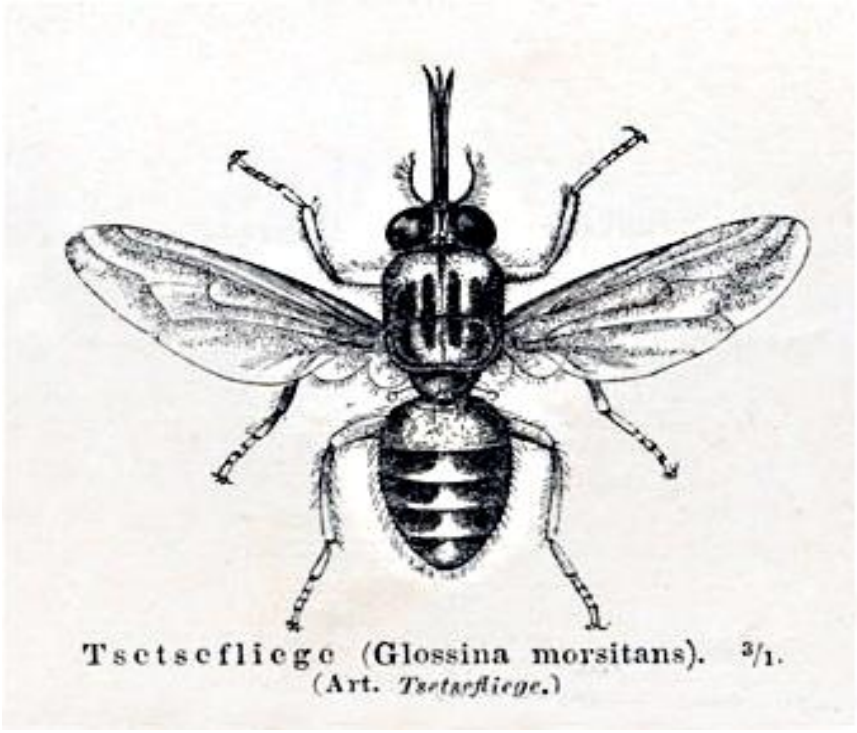
A- sanitary disposal of manure

B- application of insecticides

Life cycle :



Glossina palpalis
Glossina morsitans


Tsetsefliege (Glossina morsitans). 3/1.
(Art. *Tsetsefliege.*)

Glossina palpalis , Glossina morsitans

General characters :

1 – Adult :
Size : 10 – 15 mm
Colour : *Glossina palpalis* (black) *Glossina morsitans* (brown)
Head :

Antenna : aristate – 3rd seg. bent dorsally and tapering
Arista : branching hairs on dorsal side only
Proboscis : biting (piercing and sucking) blood – rigid
The labium is grooved dorsally to enclose the epipharynx and hypopharynx (all enter the wound during biting)
Maxillary palps : as long as the proboscis
Thorax :
The 4th vein makes a double curve giving a cleaver – shaped discal cell between it and the 5th vein
At rest wings are folded over the abdomen (Scissor like)
Abdomen: 8 segments , black with median pale strip in *G. palpalis* brown with yellow transverse bands in *G. morsitans*

2 – Egg : Larviparous - 1 lava at a time
Breeding places : G. palpalis : soil (shaded water side)
G. morsitan : soil (open land)
3 – Larva : Cylindrical with 2 posterior knobs
4 – Pupa : Barrel – shaped with 2 posterior knobs
5 – Medical importance :Vectors of trypanosomes :
A- Nagana in animal
B- Sleeping sickness in man
Glossina palpalis transmit *Trypanosoma gambiense*
Glossina morsitans transmit *Trypanosoma rhodesiense*
6 – Control :
A- change nature of breeding places

B- manual collection of pupae
C- application of insecticides

Human trypanosomiasis :

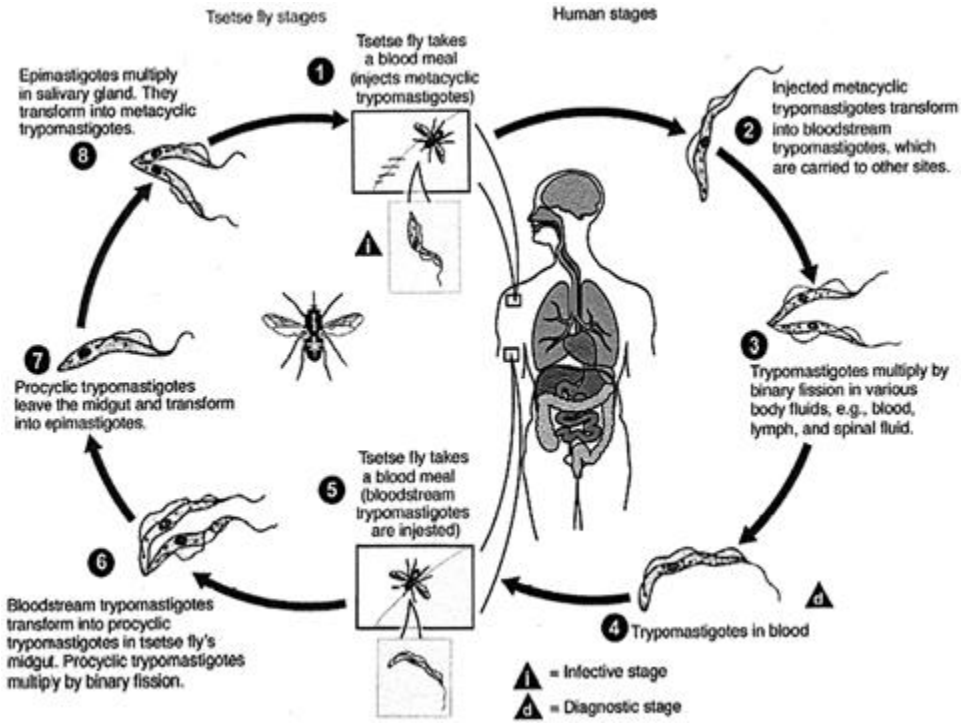
Is a parasitic disease caused by *Trypanosoma gambiense and Trypanosoma rhodesiense* and transmitted by the tsetse fly

Symptoms :

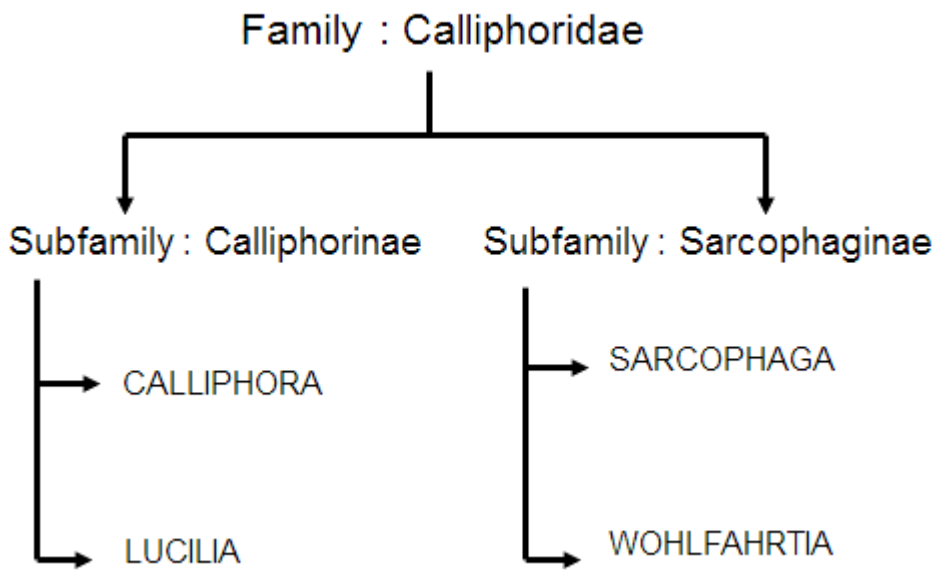
Fever , headache , joint pains and anemia as the parasites enter through both the blood and lymph systems

When the parasite passes through the blood-brain barrier the disease enter a neurgogical phase and the

sleep cycle is disturbed progressing into death if untreated



Family : Calliphoridae

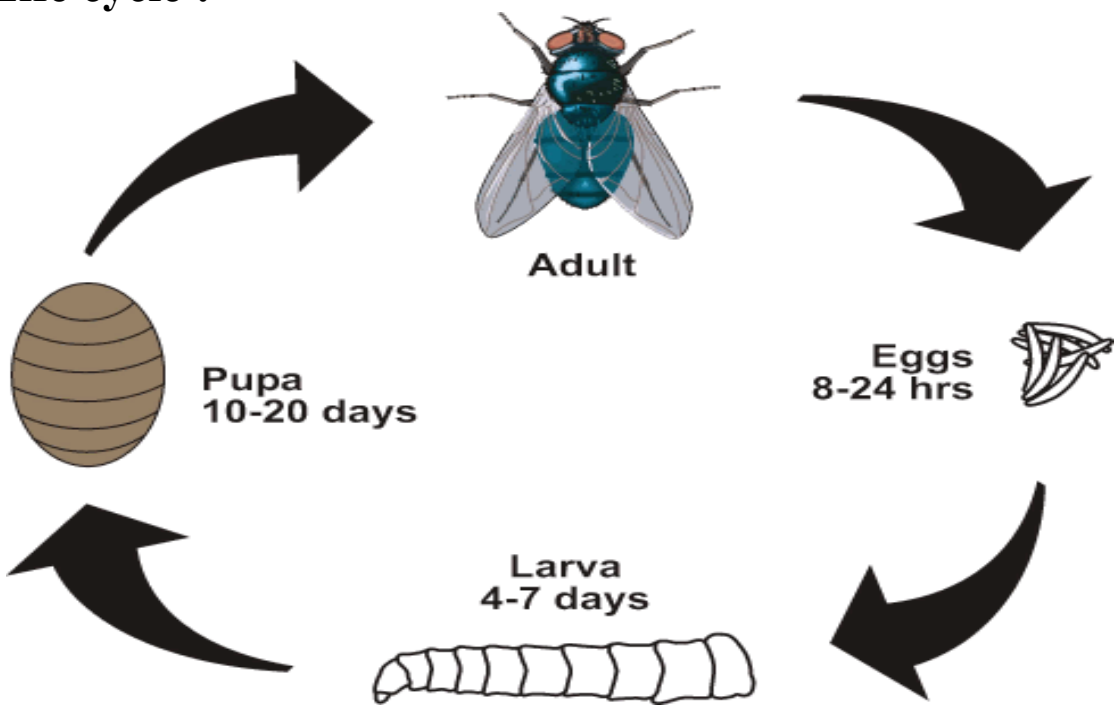


Subfamilies	Calliphorinae (Metallic flies)		Sarcophaginae (Flesh flies)	
Members	CALLIPHORA	LUCILIA	SARCOPHAGA	WOHLFARTIA
Adult				
Size	Slightly bigger than *Musca*		Bigger than *Musca*	
Colour	Blue	Green	Grey(red eyes)	Grey
Arista	As *Musca* but longer with more hairs		Distal 3rd bare	Bare
Proboscis	Sucking		Sucking	
Thorax			3 longitudinal stripes	
Wings	As *Musca*		As *Musca*	
Abdomen			Chess-board	Dark spots
Egg	As *Musca*	As *Musca*	Larviparous	
Larva Posterior spiracles	Triangular complete peritreme		Round incomplete peritreme	
Habits	Live on decaying animal or plant matter(obligatory) Or invade skin and wounds (facultative)			

Medical importance

Members of Family :Calliphoridae cause Semi – specific myiasis

Life cycle :



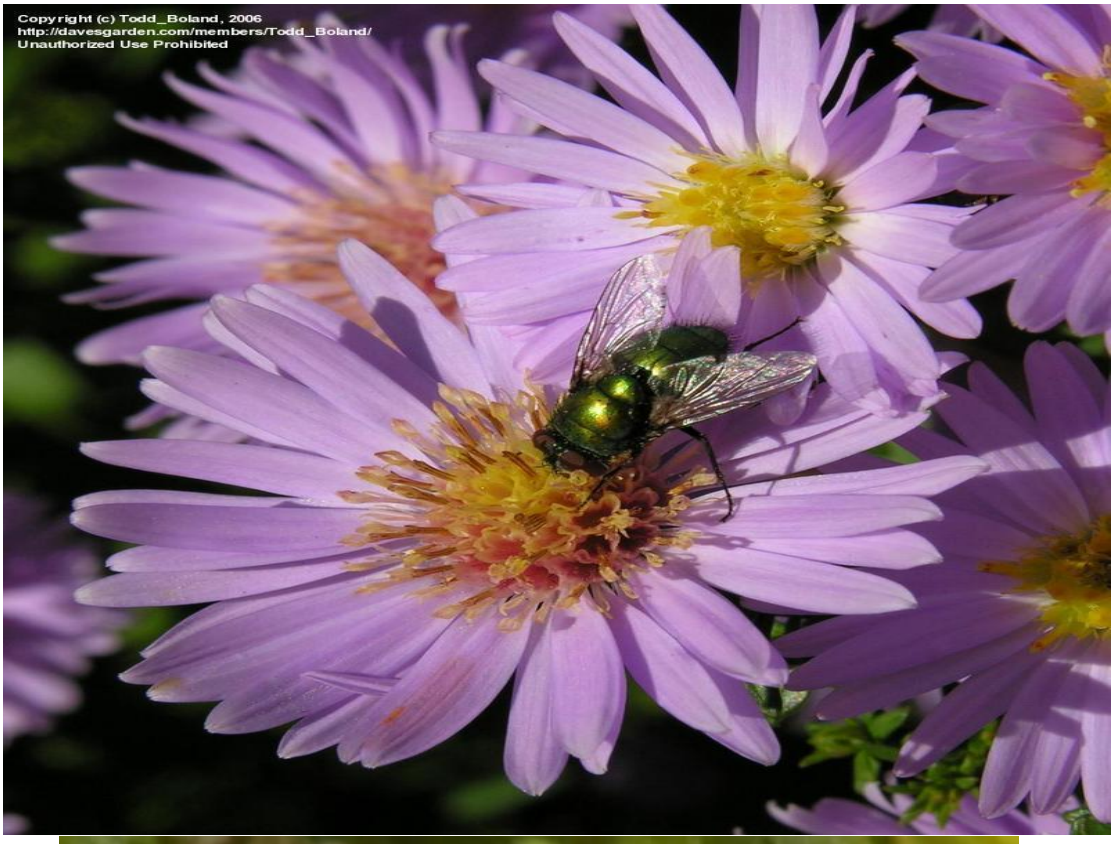
Calliphora sp.

Calliphora vicina

Lucilia sericata

Lucilia sericata


Sarcophaga carnaria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Sarcophaga haemorrhoidalis


Wohlfahrtia sp.


Sarcophaga carnaria

Myiasis

Myiasis is an animal or human disease caused by parasitic dipterous fly larvae feeding on the hosts living tissue

Some flies may lay eggs in open wounds

Other larvae may invade unbroken skin or enter the body through nose or ears

Others may be swallowed if the eggs are deposed on food

Classification of myiasis :

1 – According to the habit of the fly :

1- Specific myiasis : These are obligatory tissue parasites

larvae develop only in living tissues, so the flies

oviposit or larviposit in or near living tissues

Examples :

1-Family : Oestridae (*Oestrus* , *Hypoderma* , *Dermatobia*)

Lay eggs on some insect which when visits man and bites him the eggs hatch and larvae penetrate the skin

2-*Gastrophillus*

3-*Cordylobia*(lay eggs on ground or cloth , larvae penetrate unbroken skin)

4-some species of *Chrysomia* or *Wohlfahrtia* (larvae donot penetrate unbroken skin but wounded or diseased tissues

2– Semi–specific myiasis : these are oblgatory feeders on decayed matter but may attack tissues facultatively attracted by diseased tissues or wounds odour

Examples :

Family : Calliphoridae

3- Accidental myiasis : Larvae may accidentally get in the tissues as eggs deposed accidentally on food

Examples :

Musca , *Stomoxys*

2 – According to habitat (type of tissue invaded) :

1- Intesstinal : *Musca* , *Calliphora* , *Lucilia*

2- Gastric : *Eristalis*

3- Urogenital : *Fannia*

4- Cutaneous : *Dermatobia* , *Cordylobia* , Family : Calliphoridae

5- Ocular : *Oestrus* , *Wohlfahrtia* and *Sarcophaga*

6- Nasopharyngeal : *Wohlfahrtia* and *Sarcophaga*

Diagnosis : Finding larvae in the lesion

These are identified by the characteristic posterior spiracles

Living larvae may be reared to adult for identification
Treatment : Forcible or surgical removal of larvae

Order : Siphonaptera

General characters of Order : Siphonaptera

(Bilaterally compressed – Covered with stiff hairs directed backwardly – Strong legs to help in jumping – Complete metamorphosis)

1- Adult :

Size : 2-3 mm

Body is divided into head,thorax and abd.

Head : round or angular and carries :

2 simple eyes (may be absent)

Post cephalic hairs (one or more)

2 short 3-segmented antannae behind eyes

Genal comb in some species

Proboscis : piercing and suckuing in male and female

Thorax : composed of 3 segments and carries :

Legs : 3 pairs of strong legs particulary the coxa and femur

Pronotal comb on the posterior border of the 1st thoracic seg. In some sp.

Mesopleural suture may be present

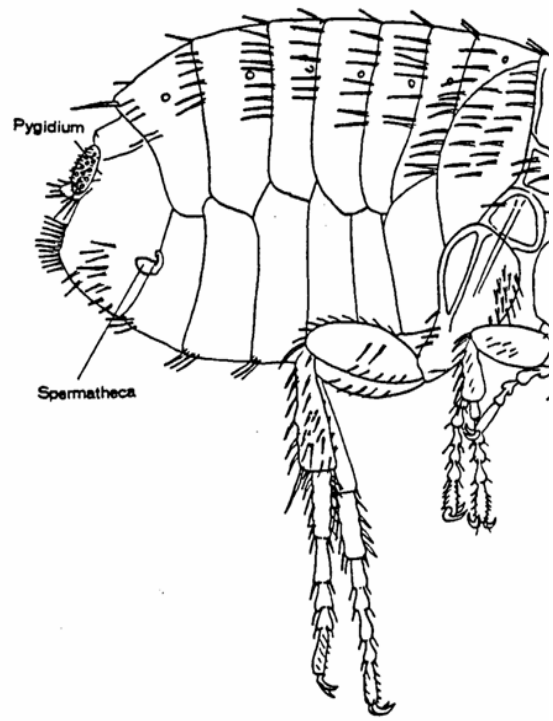
Abdomen : consists of 10 segments and carries :

Sensory plate (pygidium) on the dorsal side of 9th segment

A stiff bristle arises from the 7th segment dorsally

Male has spring-like aedegus – dorsal abdomen surface is flat or concave

Female has a comma-shaped spermatheca – dorsal convex abd. Surface



2- Egg :

Oval with blunt ends

0.5 mm – pearly white

3- Larva :

Worm like

Divided into head, thorax(3eg.) and abdomen(10 seg.)

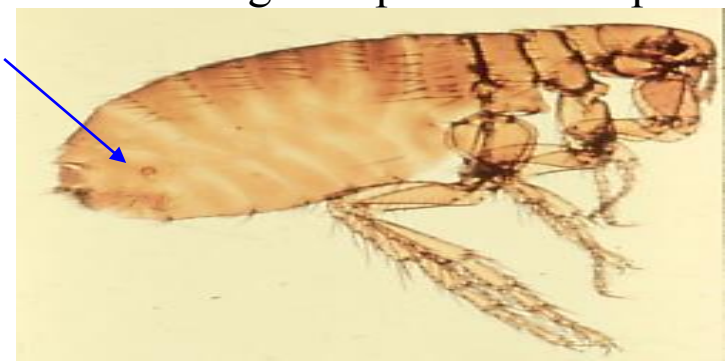
All segments carry backwardly – directed hairs

The last abdominal segment carries 2 conical hooked processes(anal struts)

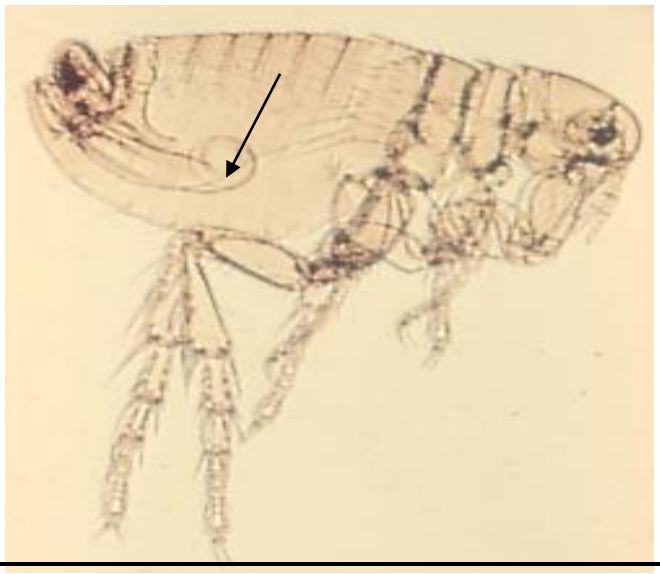
4- Pupa : enclosed in a cocoon

Morphology of a Flea

Females have an **elongate abdomen** containing a Spermatheca for storage of sperm after copulation.



Males have a **shorter abdomen** containing an elaborate copulatory apparatus with **spring-like aedegus** the largest of any animal in relation to body size!



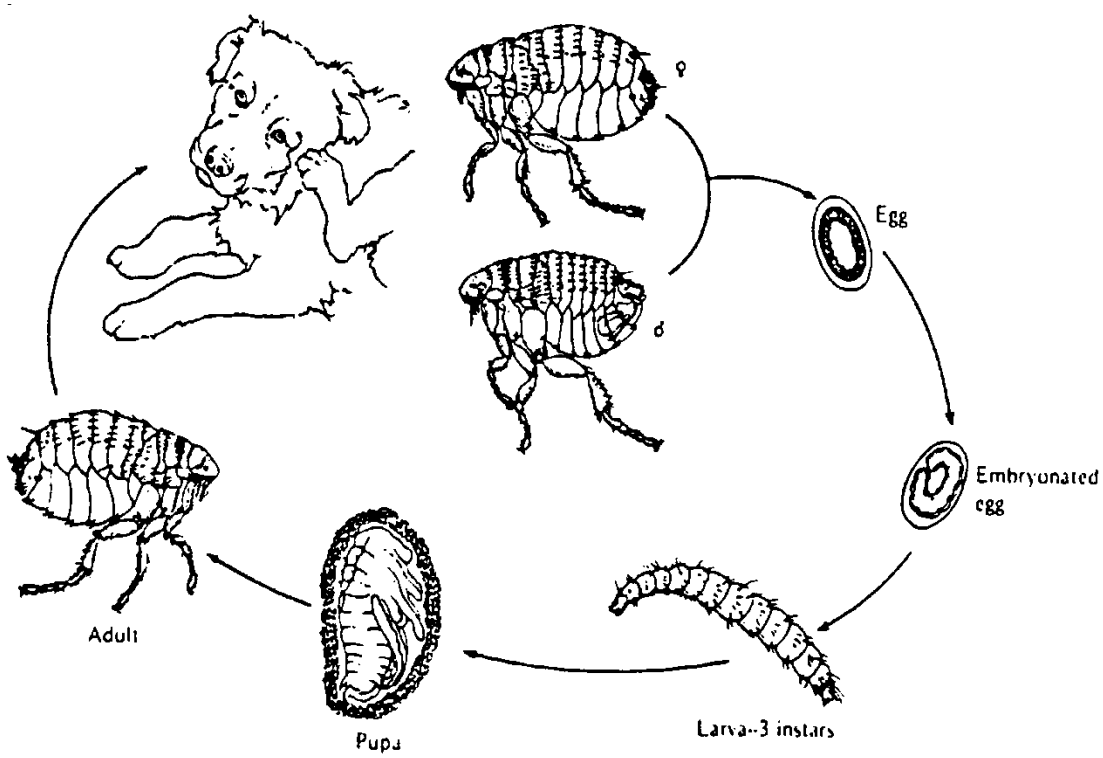
Life Cycle of the Flea

Life cycle involves **complete metamorphosis**.

1. **Eggs** deposited in hair of host which drop off host in nest area.
2. **Larva hatch** and feed on debris in the nest.
3. After 9-15 days, the larva forms a cocoon and becomes a **pupa**

Pupal stage may last a few days to a year depending upon environmental conditions.

4. **Adult** emerges from pupal cocoon and awaits the presence of a host - jumps on host when available.



Habits

1- Fleas are either temporary ectoparasites

(as the human flea) or permanent ectoparasites

(as the rat flea)

2- They feed on blood more than once daily,

but can withstand starvation for a long time

3- Season : Spring and autumn

Identification of Fleas

Species of fleas are distinguished by the presence or absence rows of spines on the head and/or thorax.

- Genal comb occurs on the head

- Pronotal comb occurs on the thorax

Examples

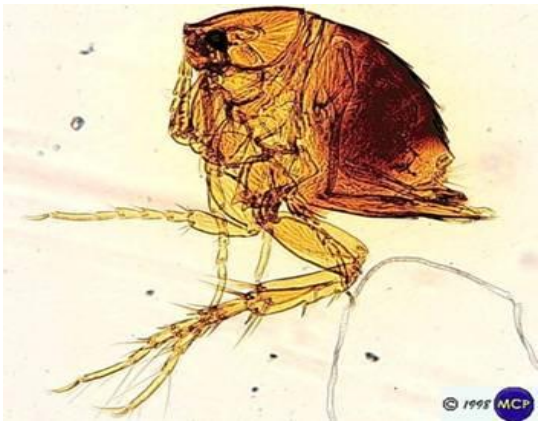
Tunga penetrans

Other names : sand flea , chigger flea

Head : angular

Thorax : compressed

Antepygidial bristle : absent



Ctenocephalides canis *and* ***Ctenocephalides felis***

Species identification is based on comparison of lengths of 1st and 2nd spines of genal comb – rounded head – normal thorax – present antepygidial comb

C. canis is identified by first spine of genal comb being about **½ length** of second spine

Dog flea

C. felis is identified by first spine of genal comb being about **¾ length** of second spine

Cat flea

Ceratophyllus fasciatus

Other names : *Nosopsyllus fasciatus*
Rounded head
Present antepygidial bristle
One pronotal comb

Xenopsylla cheopis

Other names : oriental rat flea

Rounded head

Present antepygidial bristle

Absent comb

Ocular hairs : in front of eye

A row of post – cephalic hairs is present

Present mesopleural suture

Pulex irritans

Other names : human flea

Rounded head

Normal thorax

Absent comb

Ocular hair : below the eye

Post – cephalic hairs : one hair

Absent mesopleural suture

Medical importance

Intermediate host of *Hymenolepis diminuta* ,*Dipylidium caninum* and occasionally *H. nana*أنواع من الديدان الشريطية

Vector of Murine typhus caused by *Rickettsia typhi*

These invade the gut wall and multiply

They are then liberated in the lumen after rupture of the epithelial cells

And come out with the feaces of flea

Infection occurs by contamination of the wound by feaces

Tunga penetrans **: (chigger flea) :**

Attacks man and animals
The fertilized female burrows in the skin specially of the feet between the toes and lives on blood of the host
The hindermost part of the flea projects out
The flea becomes full of eggs , swells up and eggs are expelled out
to develop and complete the life cycle on the ground
Nodular swellings are produced which may ulcerate and secondary
infection occurs

The skin becomes much inflammed and painful specially if the flea
is crushed and eggs are set free into the skin

Fleas are vectors of plague

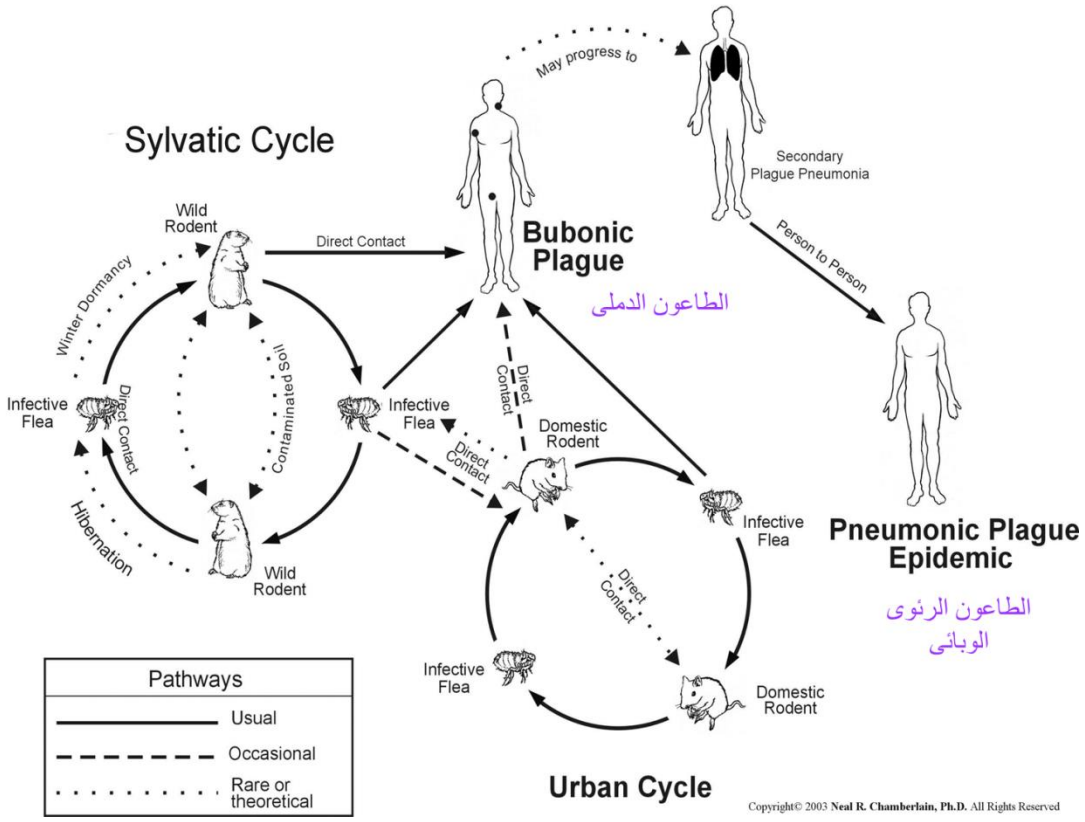
Biology of Plague

Fleas are effective vectors as the bacteria multiply rapidly within the flea's gut

Eventually the stomach fills with bacteria (*Yeresinia pestis*) which multiply and block it.

To clear this blockage, the flea will attempt to take a blood meal and will regurgitate its meal back and forth until the obstruction is cleared.

Thus, a large number of bacteria are inoculated into the bite wound as the flea attempts to clear these bacteria.



Vectors of Plague

Pulex, *Ctenocephalides*, *Diamanus*, and several species of rat fleas are vectors.

Treatment :

Antiseptic dressings

Surgical removal of fleas

Control of fleas :

Human fleas : Cleanliness and sweeping of dust from floor and carpets application of insecticides and repellents (Naphthaline)

Dog and cat fleas : Dusting animals and their resting places with insecticides

Rat flea : Dusting rodent burrows with insecticides Rodent control using rodenticides as warfarin

Order : Anoplura

General characters of Order : Anoplura

(flatenned dorso-ventrally – wingless – short legs – incomplete metamorphosis)

1- Adult louse :

Size : 2 – 5 mm (male smaller)

Body is divided into head , thorax and abdomen

Head : conical and carries :

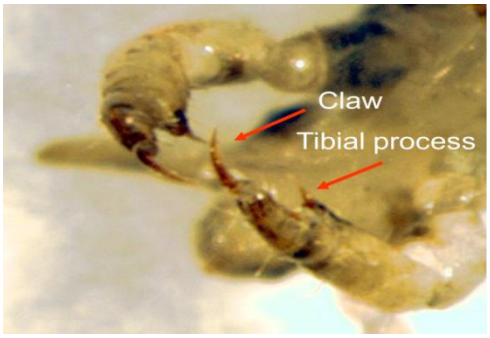
(2 simple eyes- 2 five-seg. Antannae- retractile piercing and sucking proboscis lying in a sac in male and female)

Thorax : fused segments together and carries :

3 pairs of short legs ending in a single tarsal segment and a single claw

The tibia has a prominent process (tibial process) opposite the claw to help in clinging , this process is well developed in 1st pair of male legs

One pair of respiratory spiracles



Abdomen : consists of 8 segments and carries :

6 pairs of respiratory spiracles on the sides of the 1st 6 segments

The male has a spring – like aedegus protruding from posterior end

The female has the last abdominal segment notched

and 2 triangular processes (gonopods) are found on the sides of vagina

Female

Male

2- Eggs :

Oval – operculated (crown like) – 0.8 mm – whitish

3- Nymph :

Resembles the adult but smaller and sexually immature

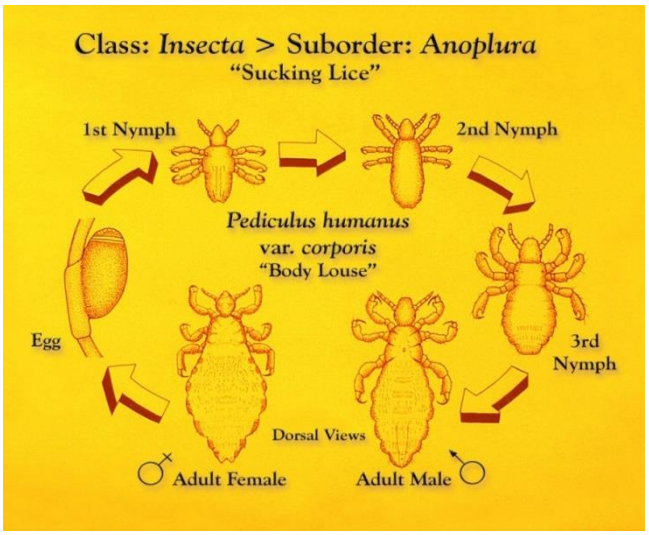
Life Cycle of *Pediculus humanus*

Incomplete metamorphosis: egg(= nit)- nymph- adult

Female cements nits to clothing fibers or hairs.

Eggs hatch into nymphs (immature adults).

Nymphs undergo 3 molts and become adults in 8-9 days.



Habits :

Lice are permanent ectoparasite, die if taken away from the host

They leave the host if the temp. rises (fever) or falls (death)

They feed on blood several times a day

Season : winter (crowding)

Pediculus humanus

Pediculus humanus capitis Head louse	*Pediculus humanus corporis* Body louse
Size : smaller	Larger
Colour : dark	Light
Antennae : shorter and stout	Longer and selender
Sides of abdomen : deeply notched	Not
Habitat : head but may spread to body	Restricted to body

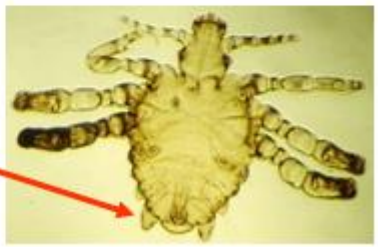
Phthirus pubis

Pubic louse or crap louse

Head is shorter and lie in a depression in thorax
Thorax and abd. Are compressed together
1st pair of legs is ill – developed
Abdomen has 5 seg.
1st seg. Carries 3 pairs of resp. spiracles
(represent 3 fused segments)

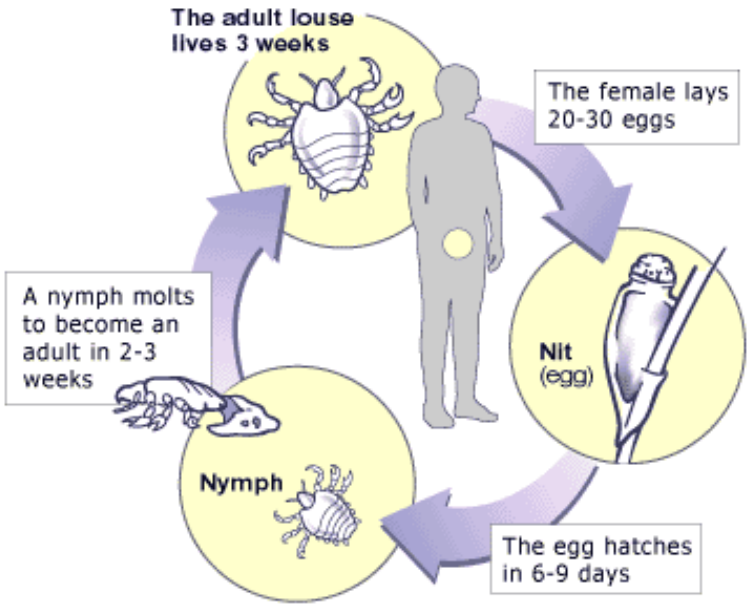
The female has a notched posterior margin and 4 pairs of lateral processes in the last 4 abdominal segments

The male has a straight posterior margin and a sraight aedegus and 2 pairs only of lateral processes in the last 2 segments



Phthirus pubis

Life cycle stages:



Habitat : pubic region , axilla and eyelashes

Not known to transmit any disease

Medical importance
Epidemic typhus : التيفويد الوبائى

Caused by *Rickettsia prowazeki*

These invade the gut wall and multiply

They are then liberated in the lumen after rupture of the epithelial cells and come out with the feaces of the louse

The life of the louse is affected by infection, it dies in about 10 days (normal span 4 – 6 weeks)

Infection occurs by contamination of bite wound by feaces, also by inhalation of dust containing rickettsia

Symptoms :

High fever – falling blood pressure – sensitivity to light – muscle pain

Rash on chest and spreads to trunk

Trench fever : حمى الخندق

Caused by *Rickettsia quintana*

The same mode of infection as in epidemic typhus

But here the life of the louse is not endangered

Epidemic relapsing fever : الحمى الوبائية المرتدة

Caused by *Borrelia recurrentis*

The organisms disappear from the gut of the louse and appear in the body fluid

Infection occurs by crushing the louse and contamination of the bite wound with the body fluid

Pediculosis : (vagabonds disease) : التقمل

This means heavy investation with lice as occurs among crowded poor people

There are cutaneous lesions

Control of lice :

Delousing by proper bathing , boiling and ironing of clothes and cutting the hairs short

Application of insecticides e.g. (5 – 10% DDT or gammaxane) in the form of dust (powder) to the body , and ointment or lotion to the head

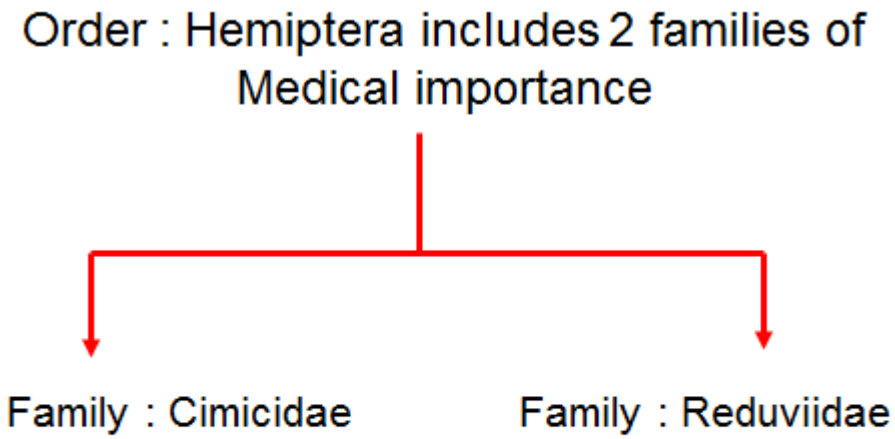
Crab lice on the eye lashes and brows are traeted with yellow oxide of mercury ointment or removed with forceps

Order :Hemiptera

(Bugs)

General chracters of Order : Hemiptera

1- Flattened dorso-venterally
2- Wings present or rudimentary
3- Undegro incomplete metamorphosis



Family: Cimicidae
Cimex lectularius
(Bedbug)

General chracters of Family : Cimicidae :

1- Adult :

Size : 5 mm - male smaller

Body : dark brown in colour
divided into head , thorax and abdomen

Head : broader than long and carries :

a) 2 prominent compound eyes

b) 2 long 5 segmented antennae

c) piercing and sucking proboscis in male and female bent under the head at rest

Thorax : composed of 3 segments :

a) prothoax extend anteriorly closing to eyes

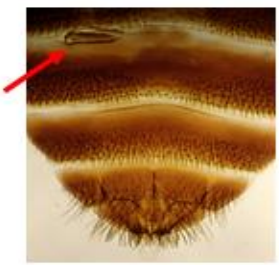
b) mesothorax covered by hemi-elytra rudimentary wings

c) metathorax covered also by hemi-elytra wings

Each thoracic segments bears a pair of legs

Abdomen : consists of 8 segments

In the male
Posterior end of the abd. is tapering
A curved aedeagus is found
in last segment



In the female
Posterior end of the abd. is rounded
The genital opening is found in the 7th seg. as longitudinal slit with triangular gonopods on either side
The opening of berlese organ is foun on the right side of 4th seg. Ventrally through which the female is fertilized and eggs are laid from the vagina

2- Egg : oval operculated (egg – plant like)

about 1 mm in length

whitish in colour

covered with adhesive substance

3- Nymph : resembles the adult but smaller and sexually immature

Life cycle :

The female lays about 2 egg / day (about 200 in life time)

Eggs are laid in cracks of walls and furniture

Eggs hatch in about one week

Nymphs feed on blood and pass through 5 instars

The adult emerges in about 5 weeks

Habits :

1- Bugs are temporary ectoparasites
2- They feed by night and hide during day time
3- They can withstand starvation a long time
4- They emit a characteristic odour

Medical importance

1- Naturally noy known to transmit any disease
2- Mechanical transmission could occur

3- Experimentally could transmit relapsing fever
(*Borrelia recurrentis*) and chagas
(*Trypanosoma cruzi*)
4- The bite of bedbug is irritating and may lead to insomnia

Control :

1- Cleanliness
2- Repair of cracks
3- Manual collection of bugs and their destruction
4- Application of insecticides to hiding places

Family : Reduviidae

Common names :

Winged bugs , Assassin bugs , Cone–nosed bugs, Barbers or Kissing bugs

Important vectors :

1- *Triatoma infestans*
2- *Panstrongylus megistus*
3- *Rhodnius prolixus*

Geographical distribution : North and South America

General characters of Family : Reduviidae :

Morphology : The winged bug is a laege insect marked with bright colours

The body is divided into head , thorax and abdomen

Head : long narrow and carries

a) 2 prominent compound eyes

b) 4 – segmented antennae

c) ventrally folded proboscis

Thorax : carries :

a) 3 pairs of legs

b) 2 pairs of wings

the mesothoracic pair has the basal half chitinised and the distal membraneous the metathoracic wings are membraneous at rest wings cross over the abdomen

Abdomen : 8 – segmented edges are sharp

Habits :

1- Hide during day in cracks

2- Bite by night

3- Attack the face (Kissing bug)

Medical importance

Disease transmission :

Chagas disease caused by *Trypanosoma cruzi*

Infection occurs by contamination of bite wound with infective feces

Chaga's Disease

- Caused by an American trypanosome, *Trypansoma cruzi*
- Spread by blood feeding kissing bugs

- Heart and blood vessel damage is a common symptom due to chemicals released by the parasites in the blood

Trypanosoma cruzi and the Kissing Bug

Control :

1- Repair of cracks and destruction of hiding places

2- Application of insecticides