Medical Entomology

*(Phlebotomus, Simulium, Culicoides, Chrysops)*, Flies and myiasis

For Third year Medical students

By

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Family: Psychodidae
**Phlebotomus papatasii**
(Sand fly)

**Geographical distribution:** More than 200 species of *Phlebotomus* are known, but only few are important medically.

They are distributed in Tropical and Subtropical countries of the Old World (*Phlebotomus* species) and the New World (*Lutzomyia* species).

*Phlebotomus papatasii* is prevalent in Egypt.
Morphology:

They are minute (2-3 mm in length) hairy insects; sandy in colour. The body consists of

**Head:** Carries a pair of dark big compound eyes, 2 long antennae, a short proboscis (adapted for piercing and sucking in female only) and a pair of maxillary palps..

**Thorax:** It makes a hump with the rest of the body. It carries 3 pairs of long & slender legs and 2 wings. The wings are lanceolate-shaped attached to the mesothorax, held erect at 45° from the body during rest.

**Abdomen:** In the female, it is bulging with convex outlines ending in a pair of cerci.

In male, the outline of the abdomen is straight and ends in claspers (accessory genitalia).

head, thorax and abdomen.
Morphology

Female

Male
Habits:

Only the female sucks blood by night and the male is vegetarian.
In day time, adults hide in burrows of rodents, in cracks or holes in walls or ground.
Sand flies cannot fly for long distances. They tend to jump for short distances.
This explains why Phlebotomus borne diseases tend to be of limited nature in distribution.
Life cycle: (Complete metamorphosis).

Eggs $\rightarrow$ Larva (L1 to L4) $\rightarrow$ Pupa $\rightarrow$ Adult
Life cycle

*They develop by complete metamorphosis
*Eggs are laid in batches in cracks, holes
*Eggs hatch in about 10 days
*Larvae come out and moult 3 times
*They become pupa in 14 days
*Adults emerge after 10 days
Cycle takes 1–2 months*
Medical importance

I– Transmission of diseases:

* **Protozoal diseases** : Leishmania

* **Bacterial diseases**: Oroya fever or Carrion‘s disease (Bartonella bacilliformis) skin nodules + severe anaemia (lysis)

* **Viral disease**: papatasii fever, sandfly fever influenza like disease

II– Harrara : allergic reaction to sandfly bite
Control

1–Filling cracks in walls
2–Screening of windows and doors by narrow nets (40 meshes /square inch).
3–Insecticides against larvae and adults (DDT & Gammamaxane).
4–Repellents to skin
Family Simuliidae

**Simulium** (Black or coffee fly)

It breeds in fast running streams of water.

**Morphology:**

**Simulium** similar to sand fly except:
1. It is black in colour.
3. Wings: are broad, short and without mottling or spotting.
4. Legs are short.

**Medical importance:**

**Simulium** acts as an **intermediate host** (Cyclodevelopmental transmission) for the filarial worm **Onchocerca volvulus** in Africa and South America.
Family Ceratopogonidae

*Culicoides* (midges)

*Culicoides* breeds in fresh, brackish or salty water.

**Morphology:**
*Culicoides* is similar to Sand fly except:
2. Antennae are long with 13 segments, plumose in male and pilose in female.
3. Wings are mottled with alternative pale & dark spots.

**Medical importance:**
1. *Culicoides* acts as an intermediate host (Cyclodevelopmental transmission) for the filarial worms *Acanthocheilonema (Diptalonema) perstans* and *Mansonella ozzardi*.
2. The bite causes irritation and pruritis.

**N.B.:** Similar species are noticed in summer nights crowing on lights, attract attention by being annoying, entering eyes, ears, nose, although transmitting no diseases.
**Suborder Brachycera**  
**Family Tabanidae**  
**Chrysops** *(mango or deer flies)*

**Morphology:**  
1. These flies characterized by their robust strong appearance with beautiful colour.
2. *Chrysops* is yellowish in colour having dark bands on wings and abdomen.
3. Antennae are 3 dissimilar segments.
4. Abdomen formed of 7 segments.

**Medical importance:**  
*Chrysops* acts as intermediate host *(Cyclodevelopmental transmission)* for the filarial eye worm *Loa loa* in Tropical Africa.
<table>
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<th>Suborder Cyclorrhapha Flies</th>
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1. Family Muscidae:
   a. *Musca domestica* (House fly)
   b. *Stomoxys calcitrans* (Stable fly).
   c. *Golssina* species (Tse tse fly).
Musca domestica
House fly

Geographical distribution: cosmopolitan

Morphology:
The adult fly is grayish, measured 7–10 mm in length. The body is divided into head, thorax and abdomen.
1. **Head** carries:
   a. Eyes: 2 compound eyes near each other in male (called holoptic) and more separated in female (called dichoptic). There are also 3 simple eyes between the compound eyes on the top of the head.
   b. Antennae: two between the compound eyes. Each is composed of three segments, first two are small, the third is big and carries a strong bristle called arista that having simple hairs on both dorsal and ventral surfaces up to its tip.
   c. Proboscis: is soft and retractile adapted for sucking in male and female and consists of rostrum, haustellum and labellae.

2. **Thorax** is of three segments and has 4 longitudinal dark strips, it carries:
   a. One pair of wings characterized by closed or very narrow opened 1\textsuperscript{st} posterior cell.
   b. One pair of halters.
   c. Three pairs of legs.

3. **Abdomen** is composed of 4 segments with dorsal median longitudinal dark stripe.
The house fly has a tendency to go inside human habitations and contaminate food and drinks. Adult male and female feed on liquid diet or solid diet after liquefying it by saliva. Also big particles as eggs or cysts of parasites can be sucked directly by mouth and later vomited or passed in the faeces. Females breed in manure, refuse and garbage.
Life cycle: (Complete metamorphosis in about one week).

1. Female lays eggs in batches (50-100 at a time) on organic matter, refuse or manure.
2. Eggs hatch in few hours (6-24) and give larvae which feed on organic matter.
3. Larvae moult two times giving 3 larval stages.
4. The 3rd larva pupates inside the last larval skin and the adult emerges after few days through a circular cut of the puparium.
Life cycle

Posterior spiracles of larva
Medical importance of house flies:

The house fly is not a parasite. It lives freely in its larval, pupal and adult stages. It is considered an efficient disease agent transmitter through:

1. **Indirect mechanical transmission** of organisms on hairs covering the body, mouth parts, legs, vomitus and faeces.

**Parasitic diseases:** Cysts of protozoa e.g. *E. histolytica* and eggs of helminths e.g. *H. nana*.

**Bacterial diseases:** e.g. typhoid, paratyphoid, cholera, bacillary dysentery and pyogenic cocci.

**Viruses:** e.g. poliomyelitis and infective hepatitis A virus.

2. Accidental myiasis.
Control

1. Wire screening of inlets and outlets of houses.
2. Protection of food and drinks away from flies.
3. Elimination of breeding places by proper disposal of refuse and garbage.
4. Spraying insecticides \textit{(e.g. D.D.T. kill larvae and adults)} They are applied to heaps of manure, garbage where the larva is expected to live and to walls in rooms where the adult is expected to stand.

\textbf{N.B} As the fly tends to show some resistance to some kinds of insecticides, it is advisable to change the insecticide used from time to time.
Stomoxys calcitrans (Stable fly)

Geographical distribution: Cosmopolitan
Breeding places: Horse dung (garbage and manure)

Medical importance:
1- Direct mechanical transmission of blood parasites (Trypanosome)
2- Accidental myiasis
3- Painful bite causing skin allergy

Control (As Musca):
1. Sanitary disposal of garbage and manure.
2. Application of insecticides mainly to animal stables
Life cycle of *Stomoxys* (complete metamorphosis)

- **Adult**: Males and females feed on nectar and mate. Most females feed on blood and develop eggs in 3–11 days.

- **Pupa**: Pupal stage completed in 4–21 days. Male adults emerge before female adults (ratio 1:1).

- **Larva**: Number of larval stages range from 6 to 13. Larvae develop during few weeks to three years (overwintering).

- **Eggs**: Mass of 100–800 eggs per female. Eggs hatch in 2–12 days.
Glossina
Tse-Tse fly

Distribution:
*Glossina palpalis*: West Africa
*Glossina morsitans*: East Africa

Breeding places:
*Glossina palpalis*: Soil (shaded water side)
*Glossina morsitans*: Soil (open land)
Glossina – Life Cycle

Female Larviposition

Adult Emerging From Pupal Case

8 – 9 days

3rd instar larva

6 (male) – 14 (female) weeks

Puparium

3rd instar larva Showing Peristalsis

4 – 5 weeks
Medical importance of Glossina

*Glossina palpalis* intermediate host of *Trypanosoma gambiense*
*Glossina morsitans* : intermediate host of *T. rhodesiense*
Causing sleeping sickness in man

*They transmit Nagana to animals*
Control of *Glossina spp.*

1–Change the nature of the breeding places to become unsuitable for the fly (deforestation)
2– Manual *collection* of the larvae and pupae
3– Spraying *insecticides* by planes on forests
4– Treatment of patients.
Calliphoridae metallic flies

1–Calliphora

Medical importance
Semispecific myiasis

Slightly larger than Musca, blue in colour
Calliphoridae
2–Lucilia

Medical importance
Semispecific myiasis

Slightly larger than Musca, green in colour
(Flesh flies)  
*Sarcophaginae* (big flies)  

They are **bigger** than *Musca*  
They are differentiated by their **abdomen**  

*Sarcophaga*: Chess board pattern  
*Wohlfahrtia*: Spotted  

Life cycle: Females are larviparous in *sarcophaga*  

Medical importance: Semispecific myiasis
Life cycle of Wholfartia sp.

Posterior spiracle
Myiasis
Definition of myiasis

It is the invasion of living human or animal tissue by larvae of dipterous flies
Classification
I- According to the habitat
(Bishopp's classification)

A- External myiasis
1- Cutaneous myiasis
  * Invasion of intact skin
  a- Creeping eruption
    (Gastrophilus Hypoderma)
Invasion of intact skin

b– Nodular myiasis
The larvae invade intact skin and produce nodular swellings
(Cordylobia and Dermatobia)
C. **Traumatic dermal myiasis**: In this type wounds and ulcers of the skin are invaded by fly larvae that producing serious damage e.g. members of Calliphoridae: *Wohlfahrtia, Sarcophage, Chrysomyia* and *Calliphora*. 
Larvae of flies may find their way to the conjunctiva or the nose. They may cause serious damage destroying the eye, the orbit or the sinuses and may reach the brain with fetal results in extreme cases e.g. larvae of *Wohlfahartia, Sarcophaga & Oestrus.*
3–Aural myiasis

Purulent or serous discharge from ears may attract flies to lay eggs or larvae there. Larvae may reach middle or inner ear or even mastoid sinuses and the brain tissues e.g. *Chrysomyia*, *Wohlfahartia*, *Sarcophaga*. 
1. **Intestinal myiasis:**

   i. The eggs or larvae find their way to the intestine with contaminated ingested food (cheese, meat, etc) e.g. *Musca*, *Calliphora* and *Sarcophaga*.

   ii. Flies deposit larvae around the anus during sleep or defecation in open latrines. These crawl into the rectum to reach the intestine e.g. *Fannia*.

**Clinical picture:**

Vary according to the number of larvae, mainly in the form of nausea, vomiting, abdominal discomfort or pain with diarrhea, even with blood if mucous membrane is invaded. Living or dead larvae may appear in stool or in the vomit leading to patient's anxiety.
B–Internal myiasis

2-**Gastric myiasis:** Gastric juice is not suitable for larvae remain in the stomach. They either pass to the intestine causing intestinal myiasis or die and are vomited e.g. *Gastrophilus* larvae in horses and *Erystalis* larva in man e.g. *Erystalis*

Symptoms: Vomiting.

3-**Urogenital myiasis** e.g. certain flies (*Fannia*)
Eggs are put during sleeping or defaecation
Symptoms: Pain during micturition.
According to habit of fly (Patton's classification):

1-Specific myiasis
Larvae of this group are obligatory tissue parasites and can develop only on living tissues (obligatory sarcobiots) members of family Oestridae (*Oestrus, Hypoderma & Dermatobia*), *Gasterophilus* and *Cordylobia*

a-*Dermatobia*
Adult lay eggs on mosquitoes legs

b-*Cordylobia*
Adult lay eggs on clothes or ground
Larvae of this group usually develop on dead tissues of man and animals (obligatory necrobiots) but they may invade neglected wound (attracted by offensive discharge of wounds (facultative sarcobiots)

e.g. *Calliphora, Sarcophaga, Lucilia, Wholfahrtia*
These flies are not parasitic in their larval stage. Infection results by accidental swallowing of eggs or larvae or by contamination of wounds e.g. *Musca, Stomoxys and Fannia.*
Diagnosis

1–Finding larvae (post. Spiracle)
2–Breeding to adult stage
Treatment

1–Removal of the larvae
*Manual (skin, eye, nose)
*Saline purge (stomach, intestine)
*douches (vagina, bladder)
*through a cystoscope in urinary myiasis

2–Treatment of secondary infection
Antiseptic antibiotic
Prevention and control

1. Control of adult flies → insecticides
2. Protection of food away from flies.
3. Prevention of wound myiasis by cleaning and covering the wounds.
Thank you