Zoology 7 (Parasitology & Entomology)

402 scbio

(Theoretical Part)

First semester

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Contents

Figures

Links

References

Chapter 1

Introduction to Parasitology

Parasitology: is the science dealing with organisms living in or on other organisms.

Parasitism:

Most plants and animals are able to live independently and are largely self-sufficient in obtaining and metabolizing the nutrients they require for their growth and reproduction. A small group of plants and animals however, are not so independent and some of these have evolved a more or less intimate relationship with another organism of a different species so that both partner benefit from the relationship. This relationship in which neither partner is harmed is called commensalisms. If, however, one partner benefits from the relationship and is unable to complete all its development and reproductive processes without the aid of the other partner, the relationship is then one of parasitism.

Parasitic relationship:

In the parasitic relationship, the half of the partnership which benefits from the relationship is the **Parasite**, and that which provides the benefit is the **Host**.

Endoparasite and Exoparasite:

When a parasite lives within its host (malaria), it is referred to as an endoparasite and is said to cause infection. A

parasite however which lives on the outer surface or in the superficial tissues of its host (flea) is called exoparasite, and is said to cause infestation.

Life cycles of Parasitism:

All parasites pass through a series of developmental stages before a stage is reached when the organism reproduces and a new cycle of development begins. There may be few or several developmental stages, with at least one stage occurring in a host organism.

Within the developmental cycle (life cycle) they may b several phases or parasite multiplication or only one. According to species the phase of multiplication may be sexual or asexual. In some parasites sexual multiplication is followed almost immediately by asexual multiplication.

Direct and indirect life cycle:

When a parasite requires only one species of host in which to complete its development it is said to have a direct life cycle, e.g. the life cycle of the parasite that cause the amoebiasis in human (Entamoeba histolytica) requires only a human host for its completion.

When two or more hosts are required, the life cycle is referred to as indirect, e.g. the filarial worms that parasitized humans required both human host and insect host in which to complete their development.

Classification of hosts:

Definite host is either:

-The host in which sexual reproduction takes place, for example human is the definite host for Schistosoma haematobium.

Or

- The host in which the mature or the most highly developed form of the parasite occurs. Human is the definite host for trypanosome.

Intermediate host:

This term is used to describe the species of host or hosts, other than the definite host, that are essential to complete the indirect life cycle of the parasite, e.g. tsetse fly is an intermediate host for the trypanosome species that cause African trypanosomiasis.

In the life cycle of the parasitic worms, intermediate hosts harbour the larval forms.

In the indirect parasitic life cycle, the term vector is usually applied only to blood-feeding arthropod intermediate hosts such as mosquitoes, tsetse flies and sandflies.

The term mechanical vector is used, to describe a vector which assist, in the transfer of parasitic form between hosts but is not essential in the life cycle of the parasite, i.e. no parasitic development occur in such a vector. An example of the mechanical vector, is the fly that transfers the amoebic cysts from infected faeces to the food that is

eaten by the humans. A non arthropod mechanical vector is called transporter, or paratenic host. In such host the parasite remains viable but does not develop.

Reservoir host (carrier):

A reservoir host is an animal in which a parasite usually resides or one in which a parasite which infects the humans is able to be maintained in the absence of the human host.

A parasitic infection in which the normal host is an animal, but can produce disease in human is called a zoonosis. E.g. leishmaniasis, and African trypanosomiasis.

Transmission and diseases caused by parasites:

Routs of transmission:

1- By ingesting the parasite in the food, water, or from hands that have been contaminated by faeces that contain the infective form of the parasite. Example: Entamoeba histolytica.
2- By ingestion the parasite in the raw or under-cooked meat. Example: Taenia saginata.
3- By ingestion the parasite in the raw or under-cooked fish, crab. Example: Fasciolopsis buski.
4- By contact with the water contaminated with parasite as in Schistosoma species.
5- By parasite entering the blood and tissues through the bite of an insect, as occur in Loa loa.
6- By inoculation of the parasite into the blood by an insect as occur with: plasmodium species.
7- By sexual contact as occur with Trichomonas vaginalis.

8- By infected faeces from an insect being rubbed into the site of the insect bite as occur in Trypanosoma cruzi.

Parasitic disease:

Not all parasitic infections cause disease of clinical significance. Many factors influence whether an infection causes disease including:

Parasitic factors:

- Number and strain of parasite.
- Strain of the parasite.

Host factors:

- Age and level of natural immunity at the time of infection.
- Immune responses to the infection.
- Presence of co-existing disease or condition which reduces the immune responses, e.g. pregnancy.

General classification (Figure 1):

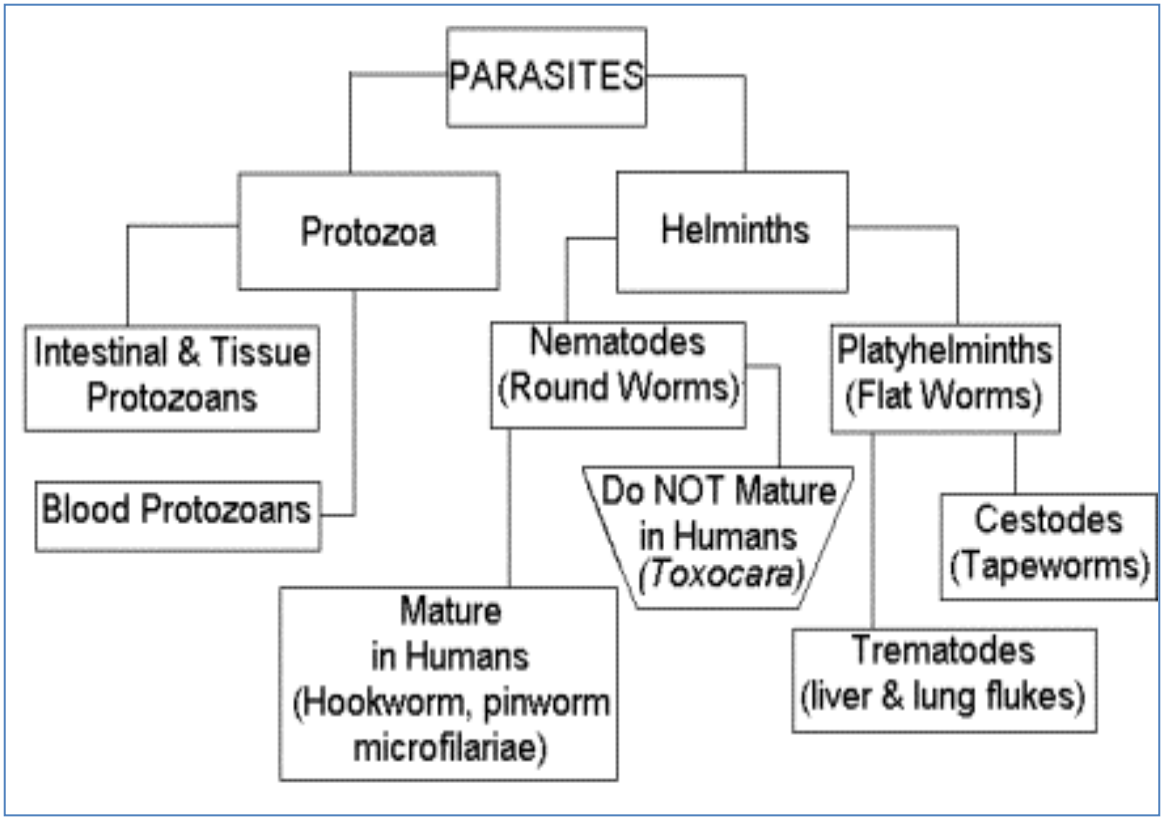


Figure (1)**:** General classification of parasites

Genus: Entamoeba

General characteristics:

Intestinal parasites amoeba of man.

Infectious stage to man the cystic stage.

Transmission is by ingestion.

Movement is by pseudopodia called amoeboid movement.

Entamoeba Histolytica.

Geographical Distribution:

Allover the world, tropical and subtropical countries. High numbers found among the countries with high temperature, or communities with bad hygiene.

Habitat :

Trophozoites (adult): found in the large intestine.

Occasionally in liver causes liver abscess.
Occasionally in lungs causes lungs abscess.

Cyst: in intestinal lumen.

No cyst is found in abscess.

Note : trophozoites and cysts are found in stool liquid fresh from a carrier, especially stool that contains blood and mucus.

Transmission and Life cycle:

Food and drinks, contaminated with feacea containing cysts of E. hystolytica

Life cycle (Figure 2):

1- After ingestion every cyst excysts in the large intestine to produce amoeba which multiply repeatedly.
2- The amoeba form single nucleated cyst which develop into infective cyst which have 4 nuclei. Once cysts are formed, they do not become amoeba again in the same host.
3- The infected cysts are execrated in the faeces. They can survive and remain infective for several weeks in sewage and water.

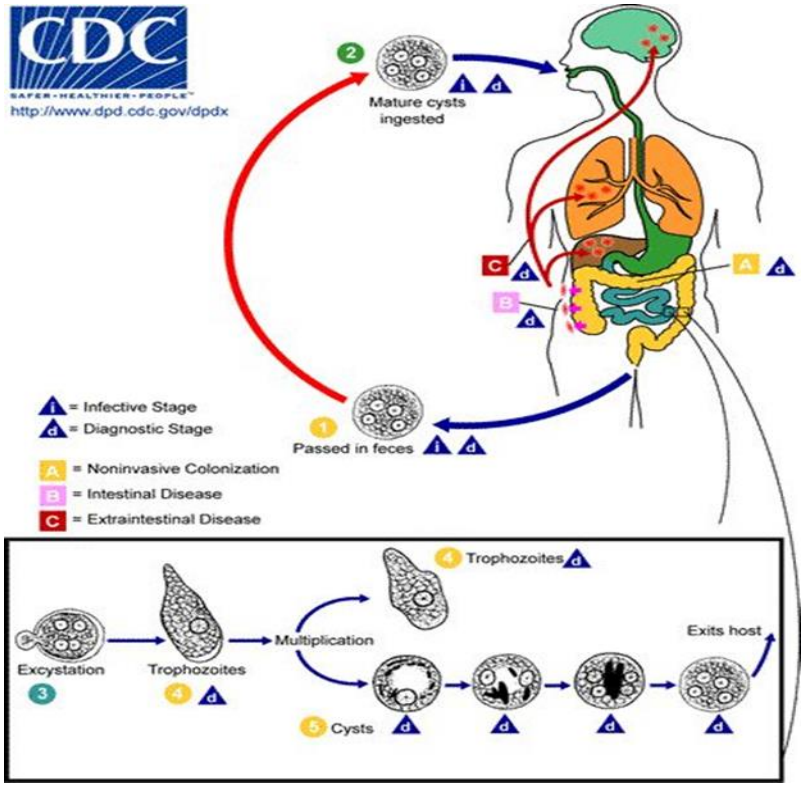


Figure (2)**:** Life cycle of *Entamoeba Histolytica*

Pathogenesis:

1. Causes ulceration of the large intestine.
2. Amoebic hepatitis and Lung abscess.
3. Rare cases of brain abscess.

Lab diagnosis:

Specimens: 1- Stool (direct or concentrated method)

2- Serum for serological tests (cellulose acetate precipitin CAP) for liver abscess.
3- Biopsy for liver, lung and intestine.

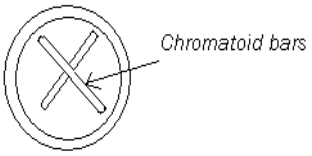
Macroscopic examination:

1- Colour.
2- Smelling (very strong bad smelling).
3- Acidic.
4- Bloody and mucous.

Microscopic examination:

1- Look for cyst.
2- Look for trophozoites

Morphology of the cyst under the microscope:

1- Wet preparation. "saline"	2- Iodine preparation.
	
We can see the chromatoid bodies (small or big, fine or thick). Sometimes we can see the stained nucleus. Glycogen mass can not be seen.	Purpose of Iodine: To see the glycogen mass clearly, and the nucleus (one to 4). We do not see the chromatoid bodies

Important points:

1- E. hystolytica cyst never shows more than 4 nucleus, if more so it will be another species of entamoeba (E. coli with up to 8 nuclues). The cyst measures about 10-15 µm.

2-Amoeba measures 25x 20 µm, and it is moving actively in the fresh worm specimen. It may contain digested RBCs .

.*Commessal Amoebe*

EX: Entamoeba Coli.

Entamoeba Coli.

Geographical distribution: all over the world.

Habitat: large intestine of the man.

Morphology: trophozoite measures 15-30 µm, the cytoplasm contains food and bacteria, no red cells.

Cyst : measures 15-30 µm, the cytoplasm contains up to 8 nuclei

In saline: chromatoid body is rare and needle-like.

In Iodine: Glycogen mass faint or diffused.

Life cycle: the same of E. histolytica but not pathogen.

Infection/ pathogenicity:

No pathogenicity.

Flagellate protozoa (Figure 3):

There are called flagellates because they move with flagella.

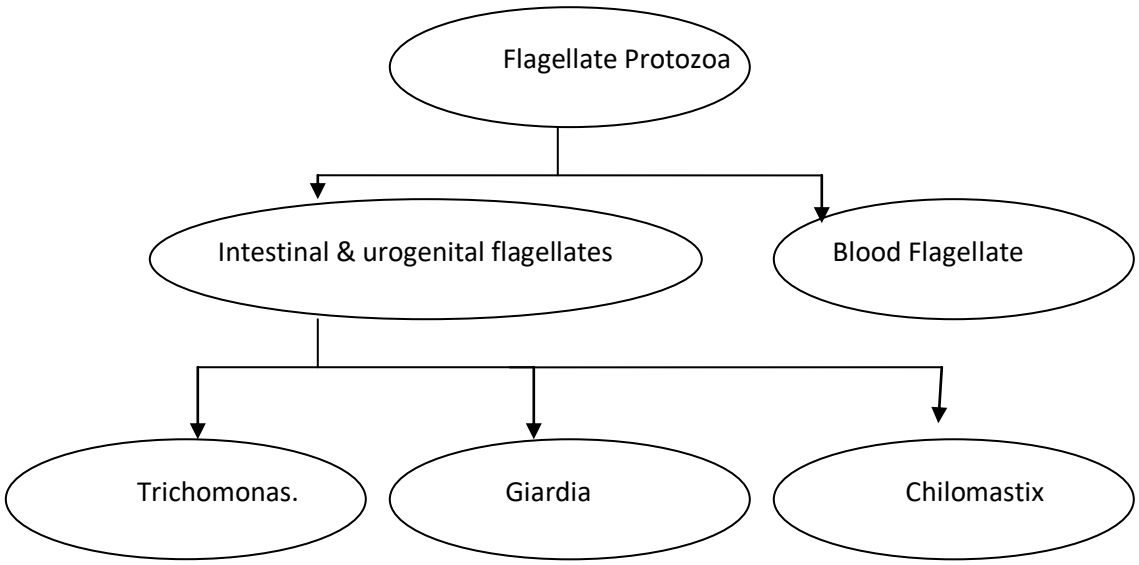


Figure (3): Classification of flagellate protozoans

Some are causative organisms for dysentery.

1) Genus: Trichomonas.

T. hominis (intestinal).

T. vaginalis (genital organs).

T. tenax (human mouth)

General characteristics of trichomonas:

1. Pear shape or ovoid.
2. Have 5 flagella, 4 directed anterior and free posterior enclosing undulating membranes.
3. Have Costa, achromatic basal red.
4. Have exosyle, a structure in the centre.

Transmission:

By ingestion, infective stage trophozoite from flagella form (flagella form).

Note: there is no cystic form.

1-*Trichomonas hominis* (Figure 4):

Geog. Distribution: all over the world, more in worm areas.

Habitat: in the large intestine especially caecum of human.

Morphology:

Trophozoite: Same as T. vaginalis.

Movement: Jerky.

Cyst: No cyst stage.

Transmission: perhaps by ingestion of the flagella form.

Infection/pathogenesis: not known.

Diagnosis:

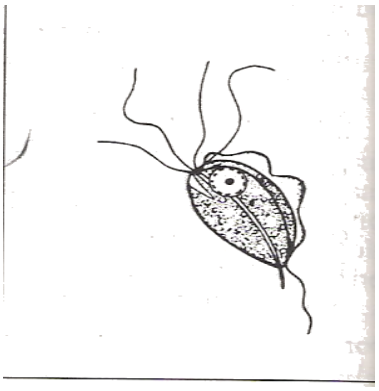


Figure (4): *Trichomonas hominis*

1. Wet preparation.
2. Seroimmnunological investigations.

3. Culture.

Specimens: blood or stool.

1- Wet preparation of stool in saline to see the active motile forms (we should examine it quickly).
2- Iodine preparation to differentiate of the morphology characters.
3- Seroimmnunological investigations (agglutination & haemoagglutination).

2-Trichomonas vaginalis (Figure 5):

Geog. Distribution: all over the world.

Habitat: In the genital tract of women and man (prostate gland).

Morphology:

1- Average length 13µm
2- 4 flagella anterior.
3- The 5^{th} passing back word to enclose.
4- Undulating membrane.
5- Has exostyle Costa & cleft (mouth).
6- Movement: twist and rotate (likened to a falling leaf).

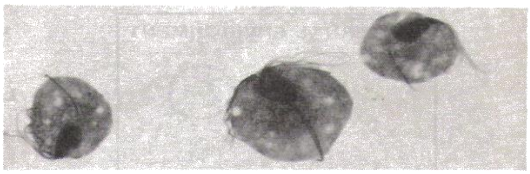


Plate 14.7 ***Trichomonas vaginalis*** **stained preparation.**
Courtesy of V. Zaman.

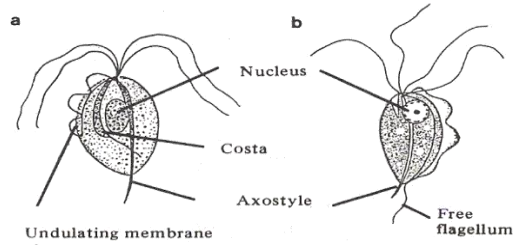


Fig. 14.4 *a Trichomonas vaginalis.*

Figure (5): *Trichomonas vaginalis*

Life cycle (Figure 6): flagella are found in the genital tract.

Transmission: during dealings with contaminated matters (clothes, cotton..etc.

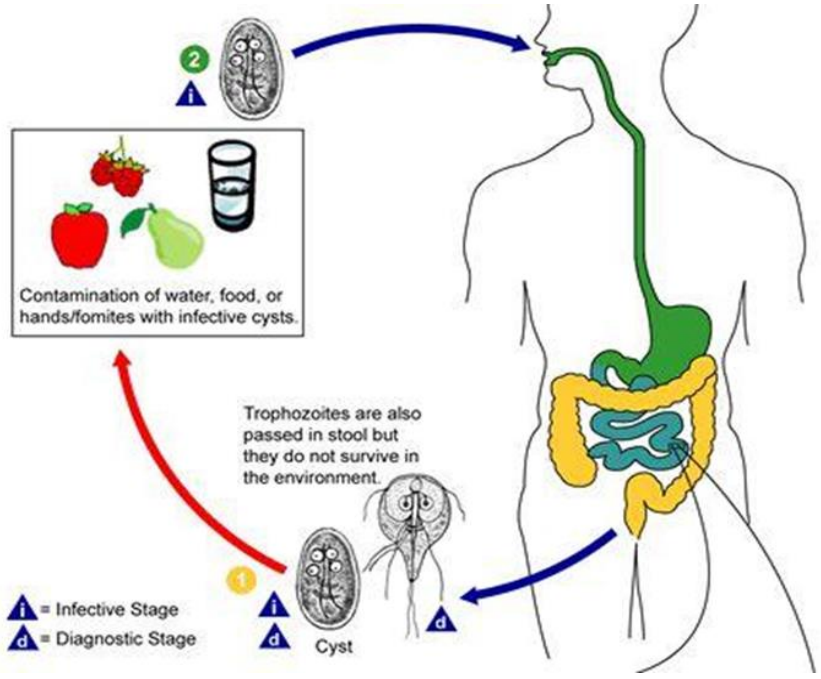


Figure (6): Life cycle of *Trichomonas vaginalis*

Pathogenesis:

In women: Vaginal discharge and vaginal scratching and itching, vaginal creamy discharge and dysuria.

In men: affects prostate gland in man and can cause urethritis and discharge which lasts 4 weeks. The discharge is mainly asymptomatic and the male can serve as carrier.

Diagnosis:

1-Specimens:

- From male: urine, vaginal swap, or urethral discharge.
- From female: urine, or prostate secretions.

2-Lab diagnosis:

1- Examination of vaginal discharge and vaginal scraping (swap).
2- Examination of urine sediment after centrifugation.
3- Stained smear.
4- Culture.

Genus: Giardia (Figure 7):

G. lambelia or G. intestinal

Geographical distribution: all over the world.

Habitat:

Trophozoite: in the upper part of the small intestine, especially in the children.

Also in faesec after laxative and diarrhea.

Morphology:

occurs as both a flagellated trophozoite and a non-flagellated cyst form

- trophozoite (9-21 µm long), motile, with 8 long flagella, ventral sucker which attaches to duodenal mucosa; lives only in small intestine; non invasive.

- cyst (8-12 µm); resistant to external environment, to municipal chlorination; intermittently expelled in stool.

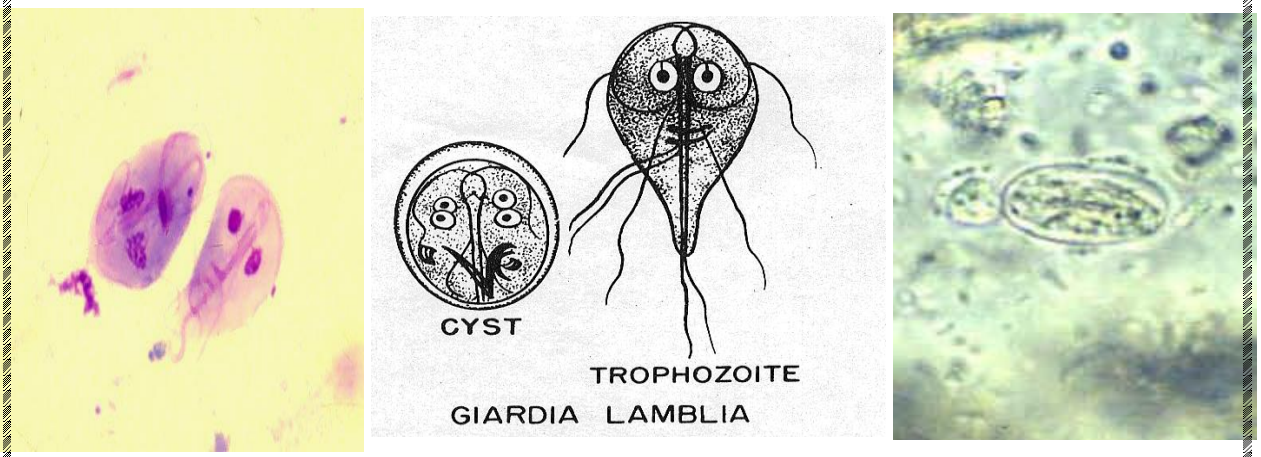


Figure (7): *Giardia lambelia*

Transmission and Life cycle:

It is transmitted by ingestion of the infected form (cyst) in contaminated food or drink.

encystment occur in the intestine. Ingestion of contaminated food containing cyst of Giardia. Within 30 minutes cyst hatches out 2 trophozoites. From stomach to the duodenum where cyst divides giving rise to 2 trophozoites. In the duodenum, multiplication of trophozoites occurs and .colonization occurs

Pathogenesis: the disease is called giardiasis, and it affects the wall of the intestine. This can lead to:

1. Nausea, flatulence and some times constipation.
2. It can result in significant morbidity among children.

Lab Diagnosis:

Specimens: stool, serum (immunodiagnosis), duodenal biopsy (histological examination).

Macroscopical examination:

The color of the stool is yellow, fattish, and with foul smelling.

Microscopical examination:

Using the saline or the iodine preparations for stool, we can detect the trophozoite and the cyst forms. The cyst is easy to be found in the stool under the high power (X40).

CILIATES

Blantidium coli (B. coli).

It is a protozoa moving by the cilia.

It is the only pathogenic ciliate in the digestive tract in man.

Geographical distribution: world wide, more in worm climate areas.

Habitat: Trophozoite in the large intestine of wild and domestic animals. Not common in human.

Infective form: the cyst is the infective form, and can be seen in the stool.

Morphology:

- Trophozoite: largest protozoa in man, measures about 50-200µm in length and has two nucleolus (macro+micro).

Transmission and Life cycle (Figure 8):

By ingestion of infective form from contaminated food or water or contaminated hands.

- ❖ Following ingestion, the cyst excyst in the intestine, each cyst producing a single ciliated.
- ❖ The ciliates multiply in the colon by binary division often following conjugation during which nuclear particles are exchanged between individuals.
- ❖ Thick walled cyst are formed which are excreted in the faeces. The cysts are infective when passed.

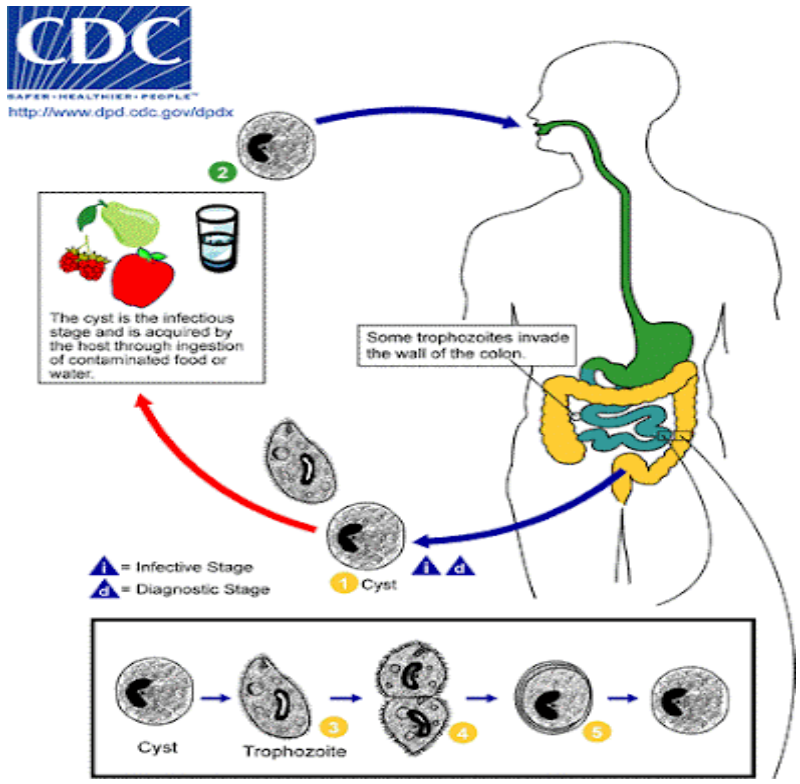


Figure (8): Life cycle of *Blantidium coli*

Look for large oval shaped ciliates which have rapid revolving motility. The ciliates are easily seen, measuring 50-200X40-70µm. by focusing the whipping cilia can be seen especially in the cytosome (mouth). In the dysentery specimens the ciliated usually contain ingested red cells.

Note: B. cloi ciliates degenerate rapidly in faeces, therefore sample should be examined while fresh.

Cysts are the parasite stage responsible for transmission of balantidiasis 1. The host most often acquires the cyst through ingestion of contaminated food or water 2. Following ingestion, excystation occurs in the small intestine, and the trophozoites colonize the large intestine 3. The trophozoites reside in the lumen of the large intestine of humans and animals, where they replicate by binary fission, during which conjugation may occur 4. Trophozoites undergo encystation to produce infective cysts 5. Some trophozoites invade the wall of the colon and multiply. Some return to lumen and disintegrate. Mature cysts are passed with feces 1.

Pathogenesis: the disease is called Blantidiasis, Blantidiasis dysentery.

It can cause ulcer in the intestinal mucous membrane, nausea, vomiting.

Diagnosis: specimen is stool.

Macroscopically we see mucous and blood.

Microscopic examination:

We can see both the cyst and\or the trophozoite.

The blood tissue flagellates

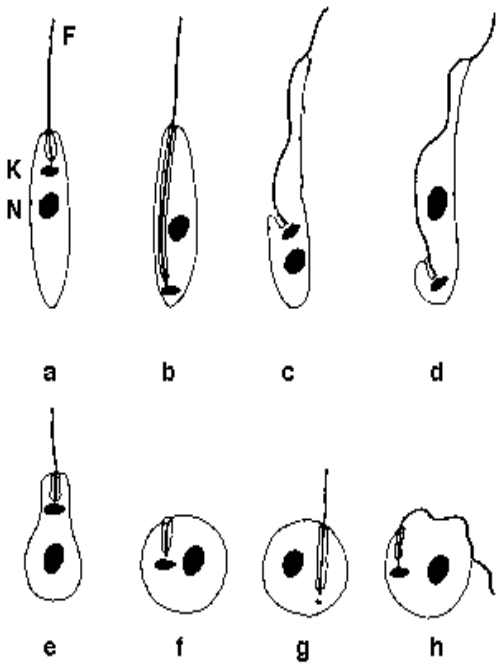
Leishmania and Trypanosoma.

Descriptive terms:

Nucleus:

- Kinetoplast: arises from axoneme.

- Undulating membrane: is not present in the non flagellate stage. It is ectoplasm of the body extending to surround the flagellum ranging along the side of the body.



Life-cycle stages of trypanosomatidae a, promastigote; b, ophistomastigote; c,epimastigote; d, trypomastigote; e, choanomastigote; f, amastigote; g, paramastigote; h,....K, kinetoplast; N, nucleus; F, flagellum.

Figure (9): Developmental stage in zoo-mastigophora

A. Amastigote.
B. Promastigote.
C. Epimastigote.
D. Trypomastigote.

Promastigote form: it is the infective form of the Leishmania.

Transmission to human occurs when the infected sand fly feed from man.

Genus: Lieshmania

Classification of Leishmania :

It can be classified into:

1. L. Donovani Complex.
2. L. Braziliensis Complex.
3. L Mexicana.
4. L Tropica.
5. L. Major.
6. L. aethiopica

It can be classified als according to the diseases which it causes into:

(1) Cutaneous Leishmaniasis (in the skin).

(2) Mucocutaneous Leishmaniasis (in mucocutaneous tissues and skin).

(3) Visceral Leishmaniasis (in the internal organs- Kalazar).

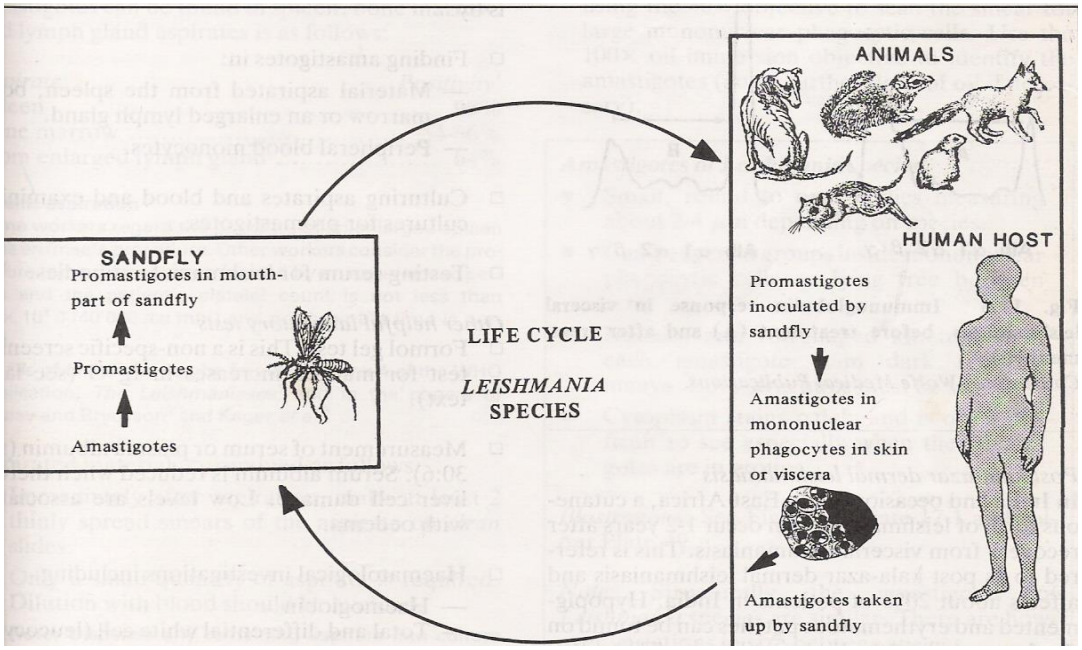


Figure (10): Life cycle of *Lieshmania* species

<u>Lieshmania donovani</u>

Geographical distribution:

India and also where, the disease is called Kala-azar.

Pathogencity:

Cause the visceral leishmaniasis or Kala azar, called the death fever, anaemia, dysentery and loosing weight.

Habitat:

Found in RES (Reticuloendothelial System) Visceral organs, specially spleen, liver, bone marrow, intestinal mucosa.

Also in: Kidney, lungs, CSF.

Stages in life cycle (Figure 11):

(1) amastigote in man and reservoirs, e.g. dog and rodents.
(2) Promastigote: in sand fly vector and in lab culture "infective stage".

In man:

2. Following inoculation, the promastigotes are taken up by phagocytic cells and develop into amastigotes.
3. Amastigotes are spread in the blood and multiply in the macrophage of the RES, e.g. liver spleen, BM…
4. Intracellular and free amastigotes are ingested by the female of sandfly vector when it sucks blood.

In sand fly vector (Phalebotomus):

5. Amastigotes become flagellated promastigotes in the midgut of the sand fly.
6. Promastigotes multiply and fill the lumen of the sand fly. After several days these move foreword to the head and the mouth of sand fly ready to be inoculated when the vector next takes blood meal.

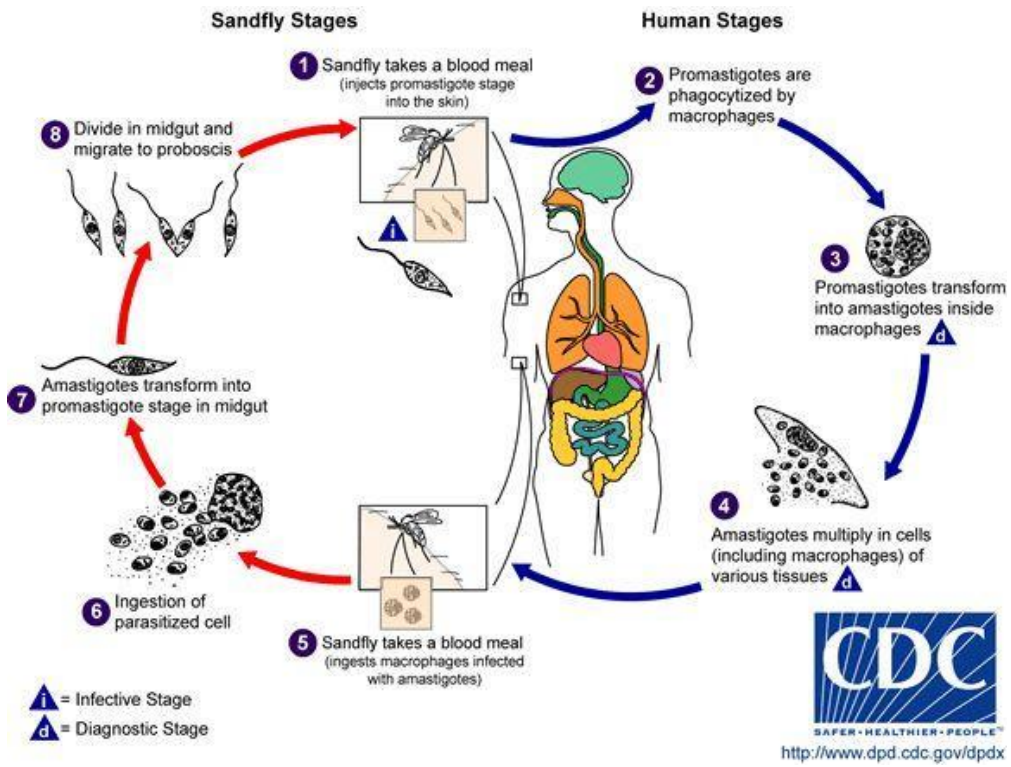


Figure (11): Life cycle of *Lieshmania donovani*

2- Leishmania causing Cutaneous (skin) Leishmaniasis:

1. L Tropica.
2. L. Major.
3. L. aethiopica

<u>Geographical distribution:</u>

Meddle east, Afghanistan, India, ethiopica and also where.

Life cycle:

The parasites multiply in the skin macrophages.

Pathogenicity:

Causes ulcer in the skin, healing.

Lab diagnosis of Leishmaniasis:

1. By finding amastigotes in:
    a) Material aspirated from spleen, liver, BM and enlarged lymph nodes.
    b) Peripheral blood monocytes.
2. Culturing aspirates for promastigotes
3. Testing serum for leishmanial antibodies.
4. Biopsy.
5. Detection of amastigotes in smear taken from infected ulcer.
6. Animal inoculation.

Genus: Trypanosoma.

Species of medical importance:

T. brucei complex (gambiense and rhodesiense) which cause the African trypanosomiasis.

T. cruzi which causes the American trypanosoiasis.

1. African trypanosomiasis.

Geographical distribution:

African trypanosomiasis occurs in tsetse fly areas of Africa (tropical, east and west).

Habitat:

1) trypomastigotes form in man (blood, CSF).
2) epimastigotes and metacyclic forms: in the midgut of the tsetse.

Transmission:

1. By bite of tsetse fly vector (intermediate host).
2. Mechanical inoculation.
3. Blood transfusion.

Life cycle (Figure 12):

During a blood meal on the mammalian host, an infected tsetse fly (genus *Glossina*) injects metacyclic trypomastigotes into skin tissue. The parasites enter the lymphatic system and pass into the bloodstream ❶. Inside the host, they transform into bloodstream trypomastigotes ❷, are carried to other sites throughout the body, reach other blood fluids (e.g., lymph, spinal fluid), and continue the replication by binary fission ❸. The entire life

cycle of African Trypanosomes is represented by extracellular stages. The tsetse fly becomes infected with bloodstream trypomastigotes when taking a blood meal on an infected mammalian host (❹, ❺). In the fly's midgut, the parasites transform into procyclic trypomastigotes, multiply by binary fission ❻, leave the midgut, and transform into epimastigotes ❼. The epimastigotes reach the fly's salivary glands and continue multiplication by binary fission ❽. The cycle in the fly takes approximately 3 weeks. Humans are the main reservoir for *Trypanosoma brucei gambiense*, but this species can also be found in animals. Wild game animals are the main reservoir of *T. b. rhodesiense*.

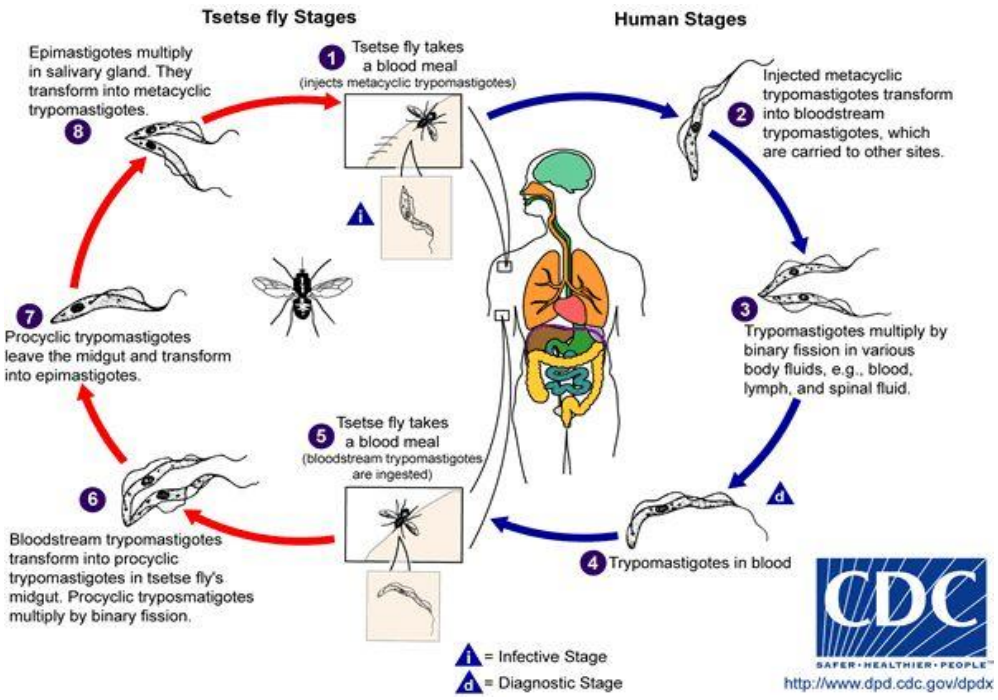


Figure (12): Life cycle of African *Trypanosoma*

Pathogenecity:

the disease is called Sleeping sickness.

1. Painful Chancre at site of inoculation
2. High Irregular fever, headache.
3. Lymphadenopathy.
4. Loss of weight, sweating.
5. Long time infection can show long time sleeping - central nervous system (CSF) involved and can lead to death.

Life cycle:

1. Metacyclic trypomastigotes are inoculated through the skin (tsetse), they develop into trypomastigotes, which multiply.
2. The trypomastigotes are carried to the heart, and various organs of the body.
3. Trypomastigotes are ingested by tsetse when it sucks blood. In the midget, the parasite develops and multiplies.
4. After 2-3 weeks, the trypomastigotes migrate to the salivary glands where they develop into epimastigote, which in turn develop into metacyclic trypomastigotes.

Morphology: spindle shape body

1- Pleomorphic trypanosomiasis: showing variety of forms measuring from 18-35µm in length.
2- Single flagella arising from kinitoplast, and extend forewords, and undulating membrane.
3- Small dot-like kinetoplast.
4- Dark centrally nucleus, with pale cytoplasm.

Diagnosis:

Specimens: blood, CSF, Lymph gland aspiration.

1- Blood examination: to detect the trypomastigotes.
- ❖ Thick stained blood film.
- ❖ Capillary tube centrifugation concentration technique.
- ❖ Test tube centrifugation concentration technique.

2- CSF and Lymph node aspirate: to detect motile trypomastigote.
3- Serological tests.

4- Inoculation in lab animals.

2- American trypanosomiasis

Geographical distribution:

South of North America, Central America and South America.

Habitat:

1. Trypomastigotes form in blood of man.
2. Amastigote: in man tissues (liver, spleen, lungs, BM, brain and lymph glands).
3. Epimastigotes and metacyclic forms: in the midgut of the Bug.

Transmission:

The infective form is the metacyclic trypomastigote, which is contained in the bug faeces, and then rubbed in wound-cut made by insect on the skin.

Life cycle (Figure 13):

- Metacyclic trypomastigote contained in bug faeces, penetrate the skin after insect bite.

- Develop into trypomastigotes which infect the RE cells near the site of bite, and multiply intracellularly as amastigotes.
- Amastigotes develop to form trypomastigote, which released into the blood when the cell is ruptured. NO MULTIPLICATION OCCURS IN THE STAGE OF BLOOD TRYPOMASTIGOTES.
- By the way of blood, Trypomastigotes reach tissue cell, and become amastigotes and multiply forming masses called pseudocycts.
- In the pseudocyctes amastigotes develop into epimastigotes, and then trypomastigotes and continue. Some of them taken by the bug through another bite.
- In the vector, it develops into epimastigotes, which multiply to give metacyclic trypomastigote in the hindgut of the bug.

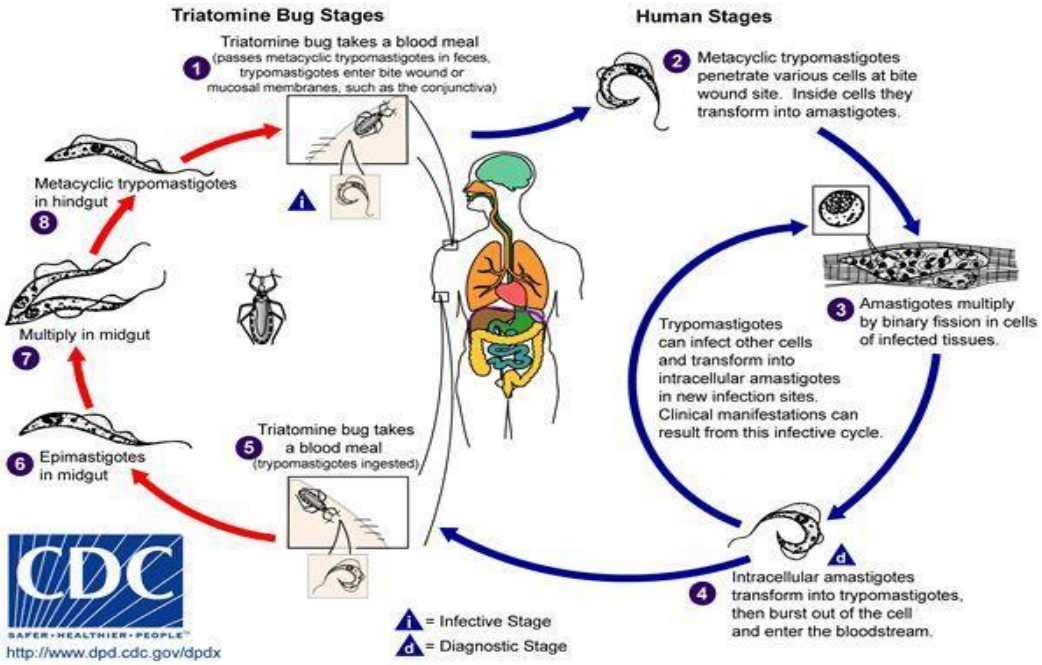


Figure (13): Life cycle of American *Trypanosoma*

Pathogenecity:

American trypanosomiasis, or Chaga's disease, Where the patient suffer of inflamed swelling, if it was in near the eyes, this is Romana signs oedema of eyelids. In the acute stage, amastigotes multiply and spread in the tissues, it causes fever, malaise, enlargement of lymph node, liver, and lesser in spleen. Acute attack for the heart can cause death.

Laboratory diagnosis:

1- By finding the trypomastigotes in the blood during early acute infection.
2- Detection of epimastigotes in the blood culture.
3- By finding amastigotes in lymph node aspirate.

4- Serum for serology.
5- Inoculation in lab animals.

Genus: MALARIA PARASITES.

The malaria parasites are protozoan parasites, belong to the family plasmodium, and classified into many species. The plasmodium which infects human are:

Widespread species	Plasmodium falciparum.
	Plasmodium vivax.
Less widespread specie	Plasmodium malariae.
	Plasmodium ovale.

The term Benign malaria is used to describe the P. Vivax and P. Ovale.

The term Malignant malaria is used to describe the P. falciparum. Quart

Transmission and Life cycle:

1- By the bite of the female of the anopheles mosquitoes.
2- By transfusion of infected blood.
3- By injection through the use of needle and syringes contaminated with infected blood.
4- Very occasionally, congenital transmission occurs.

* Two hosts involved: man and mosquito.

* The malaria of man has two stages:

1. In the anopheles a sexual, extracellular cycle of development occurs which called sporogony.

2. In human host, malaria parasite has an asexual intracellular cycle of development called schizogony, the human is the intermediate host.

Life cycle (Figure 14):

The infective stage is the sporozoites.

1- Sporozoites contained in saliva of an infected mosquito are injected into the blood of human host.
2- After circulating in the blood stream they enter the liver cells (hepatocytes).
3- They grow, multiply and develop into schizonte (pre erythrocytic schizonte), which when mature contains about 30 000 merozoites.
4- When mature, the schezonte and the liver cell rupture and merozoite enter the blood. To survive it should enter red blood cells within minutes. This stage takes 36-48 h. to complete.
5- Merozoites become trophozoites, and when fully developed will become schizontes (Schizogony) which contains 8-32 merozoites (Erythrocytic schizonte). When mature it will rupture, and release merozoites.
6- After many cycles of invading RBCs, some of the merozoites develop into schizonts which follow a sexual development and become a gametocyte which will be ingested by a female of anopheles.
7- In the mosquito, they develop into male and female gametocytes, which when fertile a zygote is formed.
8- Zygote develop multiple times to form the sporozoites which spread in the saliva of the mosquito and when bite a human start again.

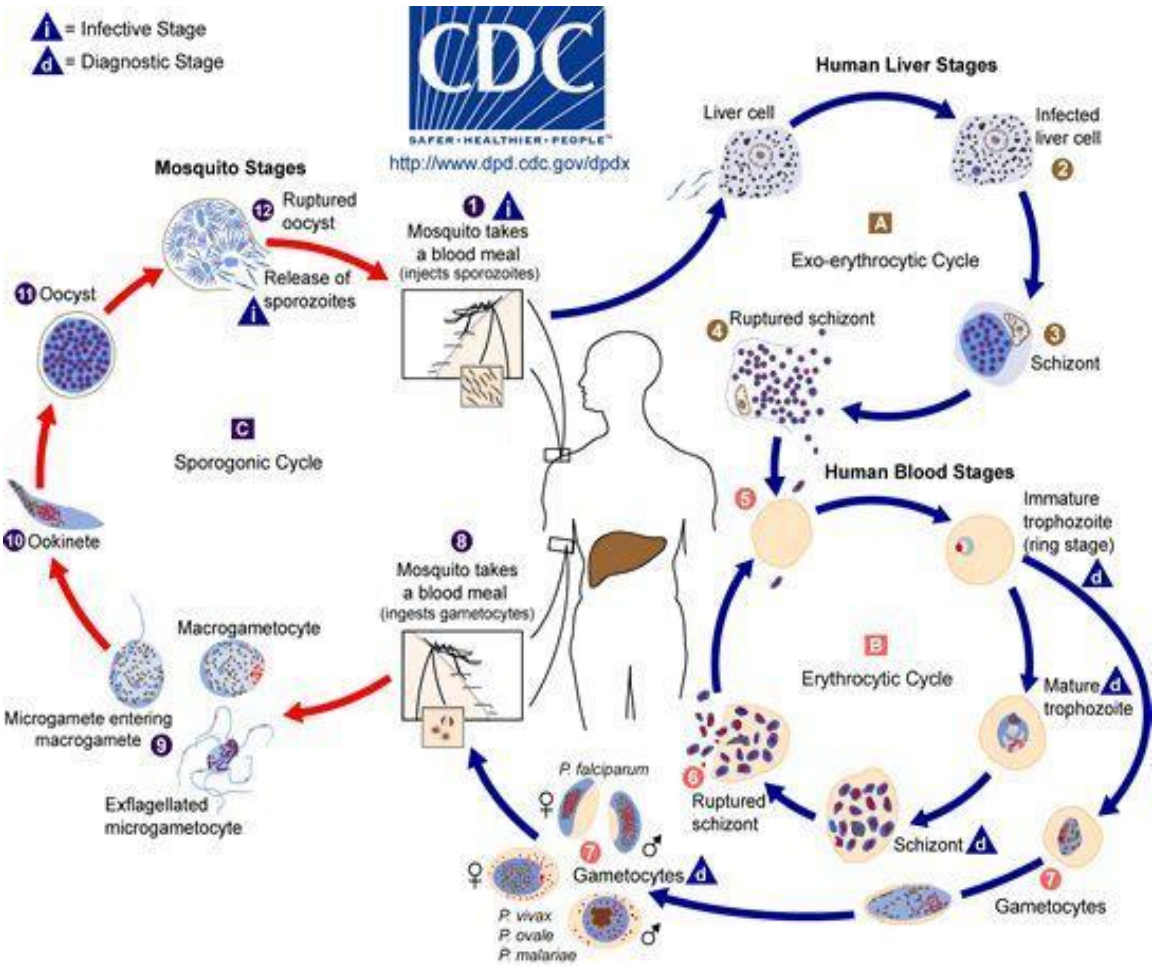


Figure (14): Life cycle of *Malaria*

Clinical features:

- The patient Feels cold, rigor and headache.
- Fever, sweating.
- Anaemia with enlarged spleen.
- Diarrhoea and vomiting.

Diagnosis:

Before starting, remember you should ask the patient if he or she has taken any anti-malaria dugs for the last 24 hours.

Specimen:

Blood, serum.

Lab diagnosis:

a- Examining the stained thick blood film to detect the parasites.
b- Examining the stained thin blood film to identify the species of the parasite.
c- Examining the Buffy coat.
d- Serological examination.

Chapter 2

Phylum Platyhelminthes

Flatworms are acoelomate, triploblastic animals. They lack circulatory and respiratory systems, and have a rudimentary excretory system. The digestive system is incomplete in most species. There are four classes of flatworms, the largely free-living turbellarians, the ectoparasitic monogeneans, and the endoparasitic trematodes and cestodes. Trematodes have complex lifecycles involving a molluscan secondary host and a primary host in which sexual reproduction takes place. Cestodes, or tapeworms, infect the digestive systems of primary vertebrate hosts.

Trematodes

The phylum Platyhelminthes contains the class Trematoda, more commonly known as the trematodes. Most of the common zoonotic trematodes are digenetic, which means these worms require a minimum of two hosts to develop into the adult stage (Nithiuthai et al., 2004). Asexual and sexual reproduction normally occur in an invertebrate and vertebrate host, respectively (Roberts et al., 2013a). Trematodes are primarily hermaphroditic with the family Schistosomidae being a notable exception (Mone and Boissier, 2004). Adult worms live in a variety of locations in the definitive host, including the lungs, liver, and stomach (Bowman, 2009). Regardless of location, operculated eggs are shed in the feces of the definitive host. After a designated time period, which is dependent on temperature, oxygen tension, and pH, the eggs will develop into a

miracidium. The miracidium is a ciliated free-living organism, which upon hatching from the egg, enters a mollusk – the intermediate host (Roberts et al., 2013e). The hatching process can occur in water or after ingestion by the requisite intermediate host. In the case of certain species such as Fasciola hepatica, light facilitates hatching .((Wilson, 1968

Once inside the intermediate host, usually a snail, the miracidium undergoes a complex series of morphological changes to the saclike sporocyst. Inside this sporocyst, other sporocysts, known as daughter sporocysts, may develop. Alternatively, another intermediate stage, the redia or germinal sac, may develop. Rediae normally exit the sporocyst in a dramatic manner, rupturing the membrane, after which they begin a wandering migration around the host. Rediae can then either develop into daughter rediae or into the next stage, which is the cercaria. The cercariae leave the host and can infect a definitive host in the case of the family Schistosomidae. In other trematodes, the cercariae will either infect a second intermediate host, where they may enter a dormant stage known as the metacercariae (Roberts et al., 2013e). Alternatively, the cercariae of some trematodes, such as the family Fasciolidae, will remain in the environment where they encyst as metacercariae (Olsen, 1947). The life cycle is completed when the definitive host ingests either the second intermediate host containing the metacercariae or the encysted metacercariae in the external environment. As with nematodes, the trematodes undergo complex

migrations within the host, after which they arrive at the designated tissue (Nithiuthai et al., 2004; Roberts et al., 2013e). The life cycle and biology described above is what would be considered a classic trematode life cycle. As with all organisms, there are notable exceptions

Liver fluke

Fasciola hepatica

order

Echinostomida

family

Fasciolidae

taxonomy

Fasciola hepatica Linnaeus, 1758, "in aquis dulcibus ad radices lapidum, inque hepate pecorum. Diss. de Ovibus;" Europe.

other common names

English: Sheep liver fluke; French: Grande douve du foie, douve du foie de mouton; German: Großer Leberegel.

physical characteristics

Adult liver flukes may reach 1.7–2.2 in (4–5 cm) in length and 0.6 in (1.5 cm) wide. They are typically about 1.3 in (3 cm) long, 0.4 in (1 cm) wide, and have a spiny tegument. They taper toward the rear. The front end bears an oral

sucker and a cone-shaped tip. The sucker on the fluke's ventral (lower) surface is larger than the oral sucker. The ventral sucker is about a third of the body length behind the oral sucker. The branched ovary is situated behind and to the side of the ventral sucker about a third of the way back in the body. The testes are also branched and extend throughout the body behind the ovary.

distribution

Worldwide, but found most often in Europe and Latin America in habitats congenial to their freshwater snail and definitive hosts.

Life Cycle (Figure 15):

Immature eggs are discharged in the biliary ducts and passed in the stool 1. Eggs become embryonated in freshwater over ~2 weeks 2; embryonated eggs release miracidia 3, which invade a suitable snail intermediate host 4. In the snail, the parasites undergo several developmental stages (sporocysts 4a, rediae 4b, and cercariae 4c). The cercariae are released from the snail 5 and encyst as metacercariae on aquatic vegetation or other substrates. Humans and other mammals become infected by ingesting metacercariae-contaminated vegetation (e.g., watercress) 6. After ingestion, the metacercariae excyst in the duodenum 7 and penetrate through the intestinal wall into the peritoneal cavity. The

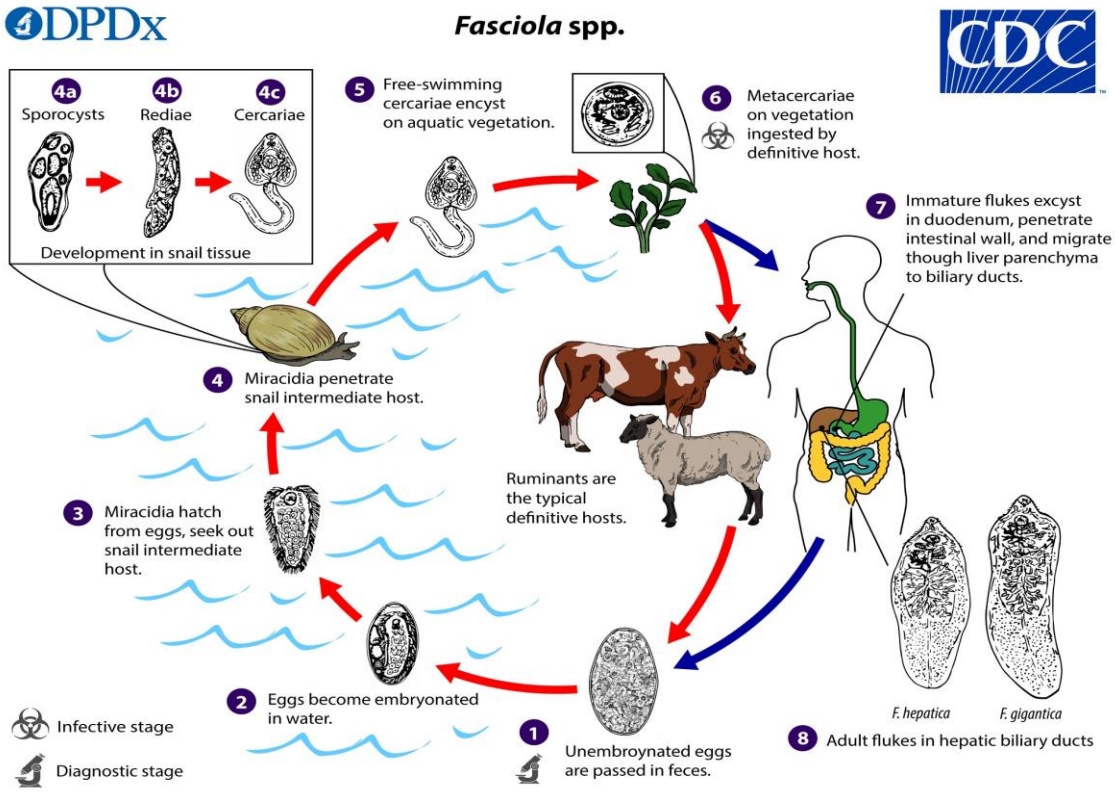


Figure (15): Life cycle of *Fasciola*

immature flukes then migrate through the liver parenchyma into biliary ducts, where they mature into adult flukes and produce eggs 8. In humans, maturation from metacercariae into adult flukes usually takes about 3–4 months; development of *F. gigantica* may take somewhat longer than *F. hepatica*.

Diagnosis

The standard way to be sure a person is infected with *Fasciola* is by seeing the parasite. This is usually done by finding *Fasciola* eggs in stool (fecal) specimens examined under a microscope. More than one specimen

may need to be examined to find the parasite. Sometimes eggs are found by examining duodenal contents or bile.

Infected people don't start passing eggs until they have been infected for several months; people don't pass eggs during the acute phase of the infection. Therefore, early on, the infection has to be diagnosed in other ways than by examining stool. Even during the chronic phase of infection, it can be difficult to find eggs in stool specimens from people who have light infections.

Certain types of blood tests can be helpful for diagnosing *Fasciola* infection, including routine blood work and tests that detect antibodies (an immune response) to the parasite.

Intestinal trematodes

The trematode Heterophyes heterophyes, a minute intestinal fluke (Figure 16).

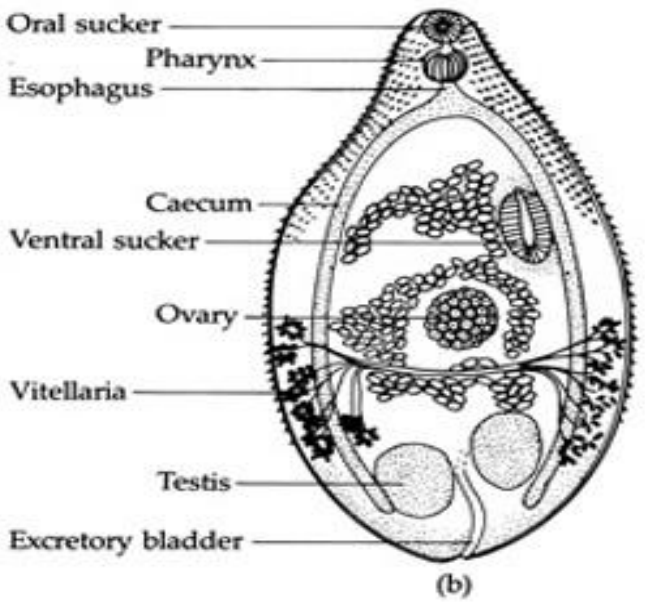


Figure (16): Heterophyes heterophyes

Geographic Distribution

Egypt, the Middle East, and Far East.

Heterophyiasis is acquired by eating infected raw or undercooked fish from freshwater or brackish water containing **metacercariae (encysted stage)**. After ingestion, metacercariae excyst and attach to the mucosa of the small intestine. There, they develop into adults, growing to about 1.0 to 1.7 mm by 0.3 to 0.4 mm.

Life Cycle (Figure 17):

Adults release embryonated eggs each with a fully-developed miracidium, and eggs are passed in the host's feces❶ . After ingestion by a suitable snail (first intermediate host), the eggs hatch and release miracidia which penetrate the snail's intestine❷. Genera *Cerithidia* and *Pironella* are important snail hosts in Asia and the Middle East respectively. The miracidia undergo several developmental stages in the snail, i.e. sporocysts❷a, rediae❷b, and cercariae❷c. Many cercariae are produced from each redia. The cercariae are released from the snail❸ and encyst as metacercariae in the tissues of a suitable fresh/brackish water fish (second intermediate host)❹. The definitive host becomes infected by ingesting undercooked or salted fish containing metacercariae❺. After ingestion, the metacercariae excyst, attach to the mucosa of the small intestine❻ and mature into adults (measuring 1.0 to 1.7 mm by 0.3 to 0.4 mm)❼. In addition to humans, various fish-eating mammals (e.g., cats and dogs) and birds can be infected by *Heterophyes heterophyes* ❽.

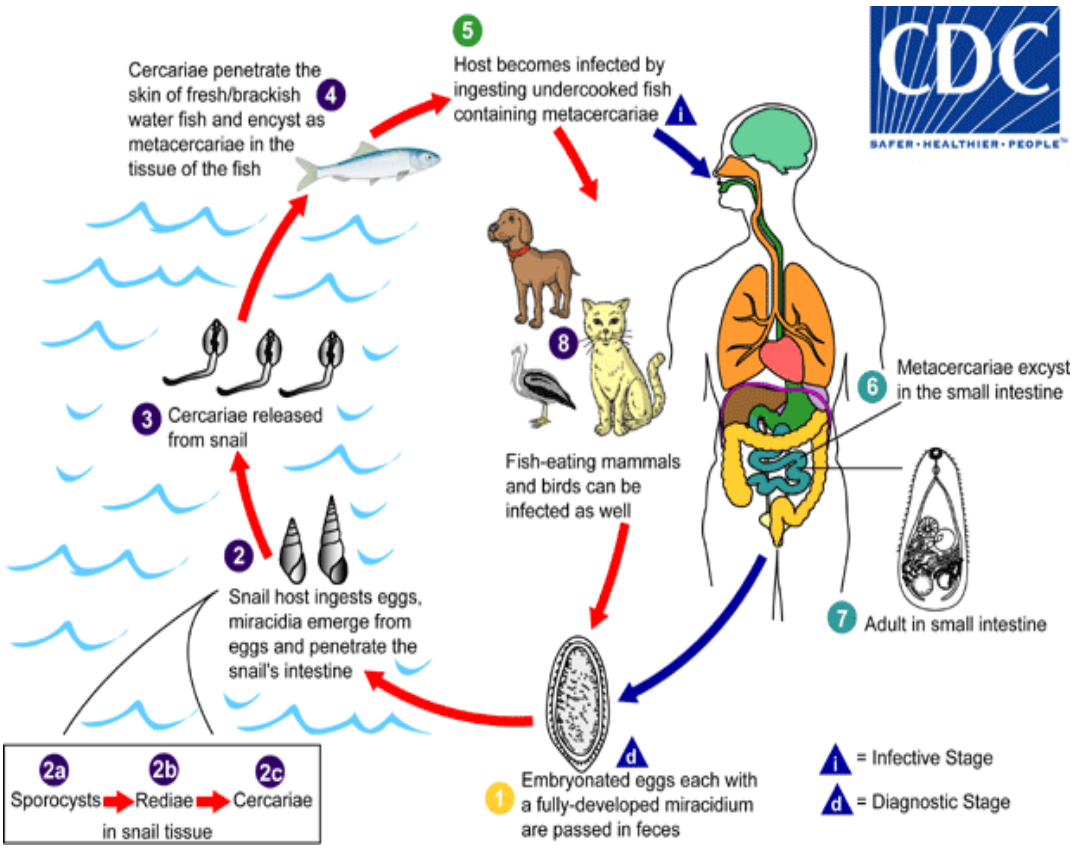


Figure (17): Life cycle *Heterophyes heterophyes*

symptoms

The main symptoms are diarrhea and colicky abdominal pain. Migration of the eggs to the heart, resulting in potentially fatal myocardial and valvular damage, has been reported from the Philippines. Migration to other organs (e.g., brain) has also been reported.

Laboratory Diagnosis

The diagnosis is based on the microscopic identification of eggs in the stool. However, the eggs are indistinguishable

from those of Metagonimus yokogawai and resemble those of Clonorchis and Opisthorchis.

Schistosomes.

Schistosomes are trematodes (flukes) that live in the blood.

Classification of medical importance schistosomes:

1- S. Haematobium (urinary).
2- S. Mansoni (intestinal).
3- S. Japonicum (intestinal).

Features of human schistosomes:

- They develop in the venous system of the intestine and bladder.
- Sexes are separated.
- They are not like the other flukes, which are flattened but they are long and worm-like.
- Human is the definite host of S. Haematobium. S. Mansoni.
- Transmission is by contact with water containing the infective form of the parasite which is the cercariae. These develop in the snail and are able to penetrate the unbroken skin.

Geographical distribution:

S. Haematobium: Africa, M. East and India.

S. Mansoni : Africa, M. East and S. America.

S. Japonicum: Far East.

Habitat:

1- S. Haematobium:
- Adult in the venous system of the bladder.
- Egg: in urine and occasionally in stool (contamination).

2- S. Mansoni:
- Adult in the venous system of the large intestine and mesenteric vein.
- Egg: in stool and occasionally in urine.

3- S. Japonicum:
- Adult in the venous system of the large intestine and gastric vein.

Egg: in stool only.

Transmission and Life cycle:

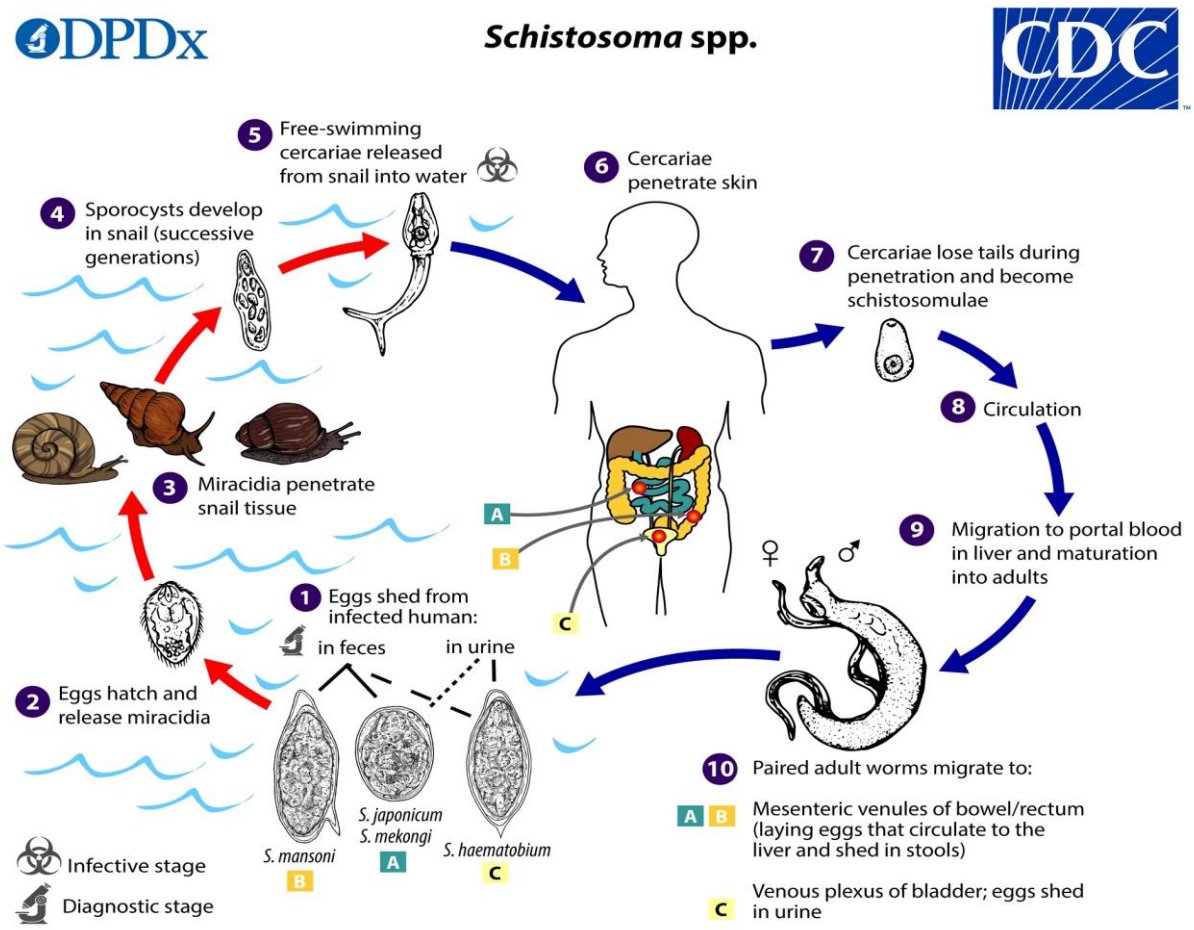


Figure (18): Life cycle of *Schistosoma*

Life Cycle (Figure 18):

1- S. Haematobium infection is caused by an infected person passing urine containing the egg of the parasite into water which is used by the others for bathing, washing, agricultural purposes, and fishing.
2- S. Mansoni infection: is caused by an infected person passing stool containing the egg of the parasite into water which is used by the others

for bathing, washing, agricultural purposes, and fishing.

3- S. Japonicum infection: is caused by an infected person or animal passing stool containing the egg of the parasite into water which is used by the others for bathing, washing, agricultural purposes, and fishing.

Schistosoma eggs are eliminated with feces or urine, depending on species (1). Under appropriate conditions the eggs hatch and release miracidia (2), which swim and penetrate specific snail intermediate hosts (3). The stages in the snail include two generations of sporocysts (4) and the production of cercariae (5). Upon release from the snail, the infective cercariae swim, penetrate the skin of the human host (6), and shed their forked tails, becoming schistosomulae (7). The schistosomulae migrate via venous circulation to lungs, then to the heart, and then develop in the liver, exiting the liver via the portal vein system when mature, (8) (9). Male and female adult worms copulate and reside in the mesenteric venules, the location of which varies by species (with some exceptions) (10). For instance, *S. japonicum* is more frequently found in the superior mesenteric veins draining the small intestine (A), and *S. mansoni* occurs more often in the inferior mesenteric veins draining the large intestine (B). However, both species can occupy either location

and are capable of moving between sites. *S. intercalatum* and *S. guineensis* also inhabit the inferior mesenteric plexus but lower in the bowel than *S. mansoni*. *S. haematobium* most often inhabitsin the vesicular and pelvic venous plexus of the bladder C , but it can also be found in the rectal venules. The females (size ranges from 7–28 mm, depending on species) deposit eggs in the small venules of the portal and perivesical systems. The eggs are moved progressively toward the lumen of the intestine (*S. mansoni*,*S. japonicum, S. mekongi, S. intercalatum/guineensis*) and of the bladder and ureters (*S. haematobium*), and are eliminated with feces or urine, respectively 1 .

Clinical features:

1- S. Haematobium:

- The disease is called "Bilharzias or Bilharsiasis", eggs classified in the bladder.
- Within 24 h. an intensive irritation may occur at the site of penetration, this is called "swimmer's itch".
- Haematuria: blood in the urine.
- Proteinuria: protein in urine.
- In heavy infections: Liver and spleen enlargement.
- Deposition of eggs in many organs in heavy and old infections.

2- S. Mansoni and S. Japonicum:

- Within 24 h. an intensive irritation may occur at the site of penetration, this is called "swimmer's itch".
- Host reaction to eggs logged in the intestinal mucosa leading to the formation of Granulomata which can cause colonic and rectal polyps.

- Ulceration and thichness of the wall of bowel.
- In heavy infections: Liver and spleen enlargement.
- Deposition of eggs in many organs in heavy and old infections.

Laboratory diagnosis:

1- S. Haematobium:

Sample: urine.

- Finding the eggs or occasionally the hatched miracidia in urine.
- Detecting eggs in the rectal or bladder mucosal biopsy.

2- S. Mansoni:

- Finding the eggs in faeces and may also be found in urine.
- Detecting eggs in the rectal in biopsy if they are not found in faeces.

3- S. Japonicum:

- Finding the eggs in faeces.

- Detecting eggs in the rectal in biopsy if they are not found in faeces.

Other finding:

- Mucous and blood in the stool in the urine.
- Blood eosinophili .
- Bacteriuria.

Chapter 3

Tapeworm (cestodes)

Taenia (cysticercus), Echinococcus (hydatid), Diphyllobothrium, Hymenolepis, Dipylidium

General Structure of Tapeworm

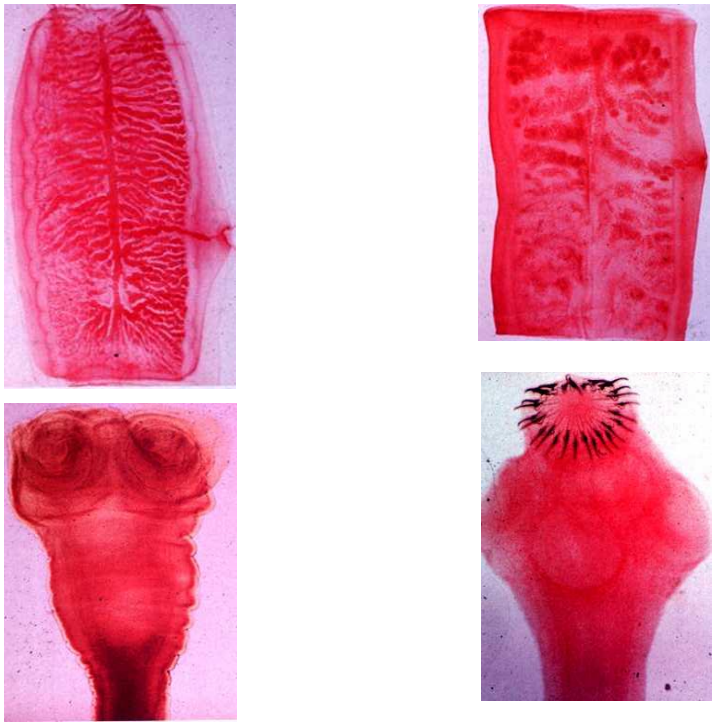
Head region (scolex) : contains suckers (1) and hooks (2) used to attach to a host organism.

Identification of scolex:

It is very small measuring only one mm in diameter.

The scolex has four suckers and crown of hooks.

Taenia saginata and T. solium:
Scolex And Proglottids



(A) (B)

Figure (19): *Taenia* species. Fig. (A): *Taenia saginata*. Fig. (B): *Taenia solium*

Zone of Proliferation - Undifferentiated area behind the scolex (neck region)

Strobilia - Chain of segments (proglottids)

Proglottids : square body segments used for reproduction.

Immature proglottids - developing reproductive

Mature proglottids: mature reproductive organs .

Gravid proglottids: contain eggs in the uterus.

Tapeworms are of considerable medical and economic importance. About 50 million people are infected with Taenia saginata or T. solium, and about 50,000 people die annually of cysticercosis, an infection with larval Taenia. The morphology, life cycles and medical importance of tapeworms (Platyhelminthes, Eucestoda) are discussed. Particular attention is paid to Taenia solium (which causes cysticercosis in humans), Taenia saginata, Echinococcus granulosus and Echinococcus multilocularis (which cause cystic and multilocular=alveolar hydatid disease in humans, respectively), Diphyllobothrium latum, and some other tapeworms of man and domestic animals

Main features of the cestodes:

1. Adults of most live in the small intestine.
2. Human is the definite host of the T. Saginata and T. Solium.
3. Transmission of Taenia species is by ingestion of cysticercus larvae in undercooked beef (T. Saginata) or pork (Solium).
4. Laboratory diagnosis:
5. Is by finding gravid segments and eggs in the faeses. The eggs of T. Saginata can also be found in the perianal area.
6. Body is divided into segments.

1- *Taenia Saginata* (Figure 19A)

Distribution:

T. saginata has a wide world distribution.

Life cycle (Figure 20):

1. After ingestion of egg, the scolex (head) is freed and become attached to the wall of the small intestine by its suckers. Segments are formed from the neck region and within 2-3 months grow into adult tapeworm with gravid (egg-filled) segments being found at the tail end. Usually one worm present but multiple can occur.
2. When fully developed, the graved become attached and eggs passed in stool.
3. To continue, eggs must reach the place of cattle food, after ingestion by a cow, pass through the intestine wall to the muscles, where the egg grows into infective larvae.

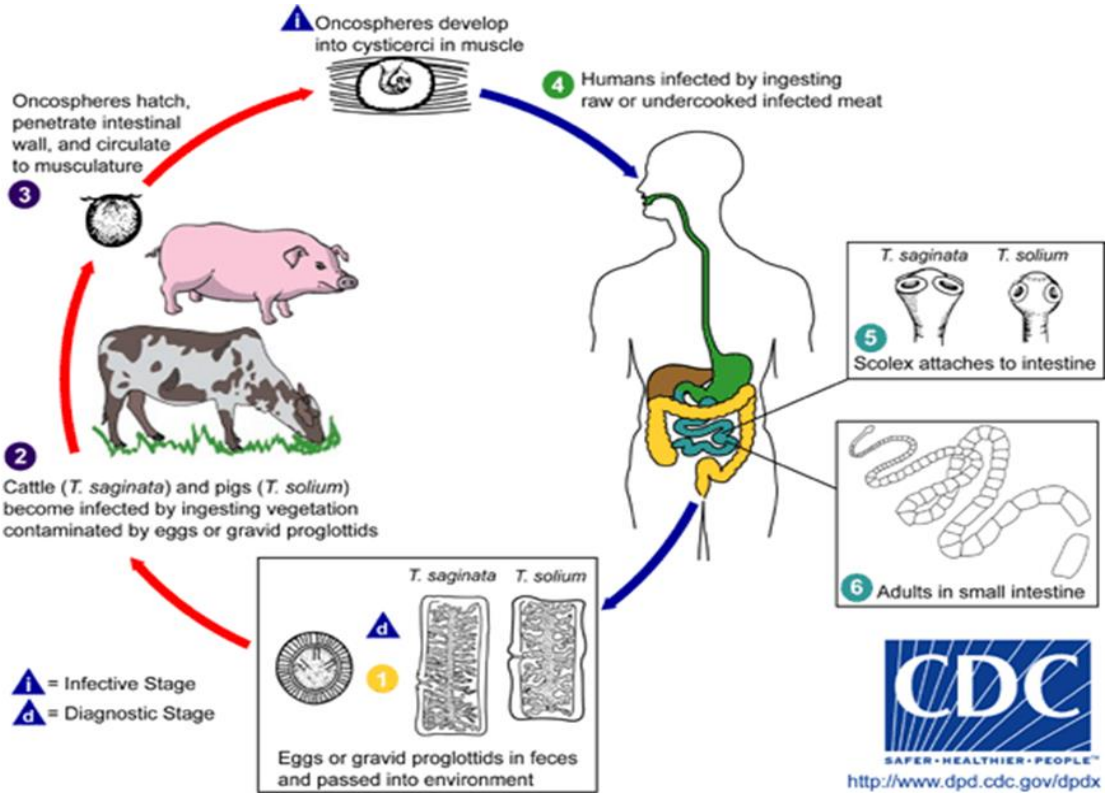


Figure (20): Life cycle of *Taenia saginata*

Clinical features:

Usually infection rarely produces serious features. They may be abdominal pain with intestinal disturbances and loss of appetite. Very occasionally appendicitis can occur.

Identification of *T. saginata* scolex:

It is very small measuring only two mm across. The scolex has four suckers and no hooks. The absence of hooks distinguish it from T. Solium.

2 - *Taenia Solium* (Figure 19B):

Distribution:

T. solium present mainly in Ethiopia, southern Africa and china .

Life cycle (Figure 21):

4. After ingestion of egg, the scolex (head) is freed and become attached to the wall of the small intestine by its suckers. Segments are formed from the neck region and within 2-3 months grow into adult tapeworm with gravid (egg-filled) segments being found at the tail end. Usually one worm present but multiple can occur.
5. When fully developed, the graved become attached and eggs passed in stool.
6. To continue, eggs must reach the place of cattle food, after ingestion by a pig, pass through the intestine wall to the muscles, where the egg grows into infective larvae.

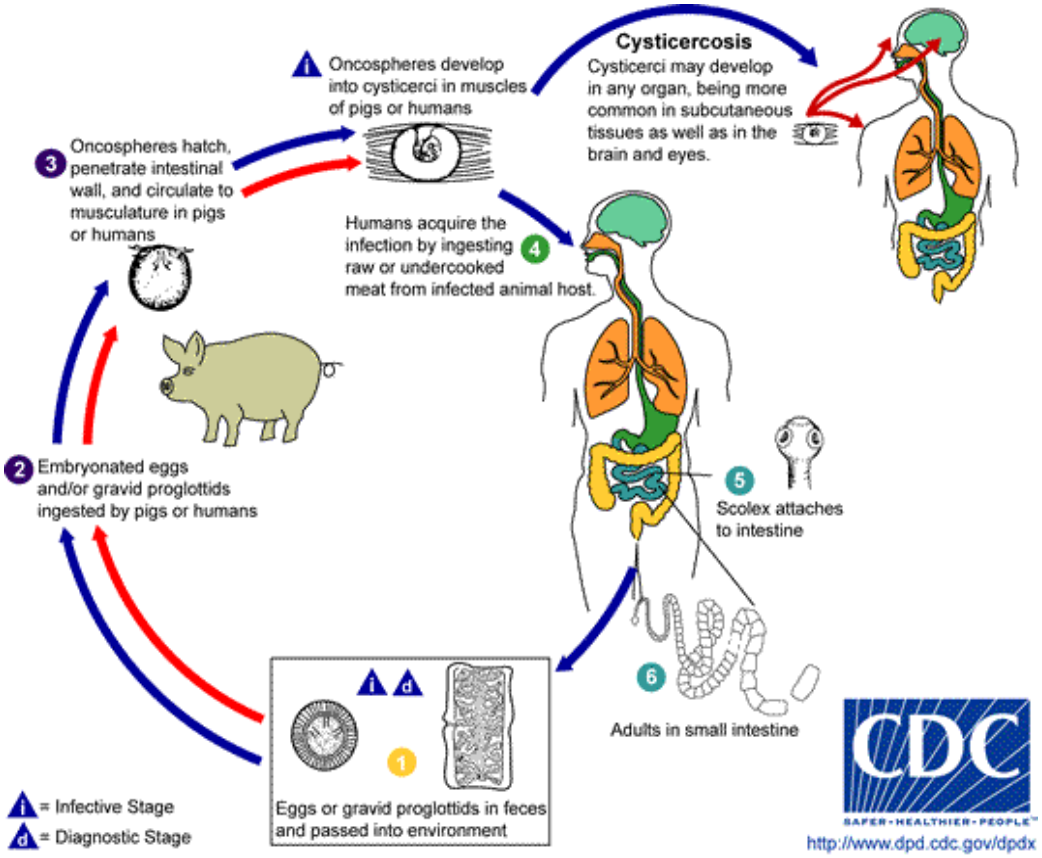


Figure (21): Life cycle of *Taenia solium*

Diagnosis

Diagnosis of Taenia tapeworm infections is made by examination of stool samples; individuals should also be asked if they have passed tapeworm segments. Stool specimens should be collected on three different days and examined in the lab for Taenia eggs using a microscope. Tapeworm eggs can be detected in the stool 2 to 3 months .after the tapeworm infection is established

Tapeworm eggs of T. solium can also infect humans, causing cysticercosis. It is important to diagnose and treat all tapeworm infections.

Cysticercosis

Cysticercosis is a parasitic tissue infection caused by larval cysts of the tapeworm Taenia solium. These larval cysts infect brain, muscle, or other tissue, and are a major cause of adult onset seizures in most low-income countries. A person gets cysticercosis by swallowing eggs found in the feces of a person who has an intestinal tapeworm. People living in the same household with someone who has a tapeworm have a much higher risk of getting cysticercosis than people who don't. People do not get cysticercosis by eating undercooked pork. Eating undercooked pork can result in intestinal tapeworm if the pork contains larval cysts. Pigs become infected by eating tapeworm eggs in the feces of a human infected with a tapeworm.

Chapter 4

Nemathelminthes (Round or Cylindrical worm)

Intestinal Nematodes.

Genus: Ascaris.

Species: A. Lumbricoides.

Major features of the intestinal round worms:

- Long cylindrical, non segmented.
- Adult worms live in the intestinal tract.
- Have alimentary canal with mouth and anus.
- Separated sexes (male and female).
- Some have free living while others are saprophytic.
- Female is longer than male, and some have spicules.
- Adult worms are oviparous, egg to larvae then adult worm.
- Some are laviparous: larvae then adult. Example: Strongyloides.
- The term filariform is used to describe the infective larva form that cause infection by penetrating the skin, i.e. S. stercoralis and Hook worm.
- The term rhabditiform is used to describe the non infective larva form that hatch from the egg in the intestine.

Geographical distribution:

World wide distribution, common among children and poor living standard.

Transmission and life cycle:

By ingestion contaminated food, water, or from hands that have become faecally contaminated.

Morphology:

A. Egg:

1. Fertilized egg: yellow-brown and the shell is covered by an albuminous coat. Oval or round measures 60x40 µm. contains a central granular mass which is an unsegmented fertilized ovum.

2. Unfertilized egg: occasionally found. Darker in colour, more elongated.

B. A. lumbricoides worm:
Large, female measures 20-35 cm long.

By 3-6 mm wide and male worms' measure 15-30 cm long by 2-4 mm wide, it is pink-brown or yellow-white in colour. Tale of male has two small spicules (rod-like projections). When examined with magnifying lens, three small lips can be seen around the mouth.

THE INFECTIVE FORM IS THE EGG.

Life cycle (Figure 22):

- Following ingestion of infective egg, the larvae hatch in the small intestine and penetrate the wall toward the blood vessels.
- In the circulation, larvae migrates to the lung-heart circulation during which they develop.
- After migration up to the trachea, they remain in the small intestine and grow into mature worm.
- After mating, the female produces large numbers of eggs which are passed in faeces.
- In soil and under special situations, eggs become infective by containing infective larvae.

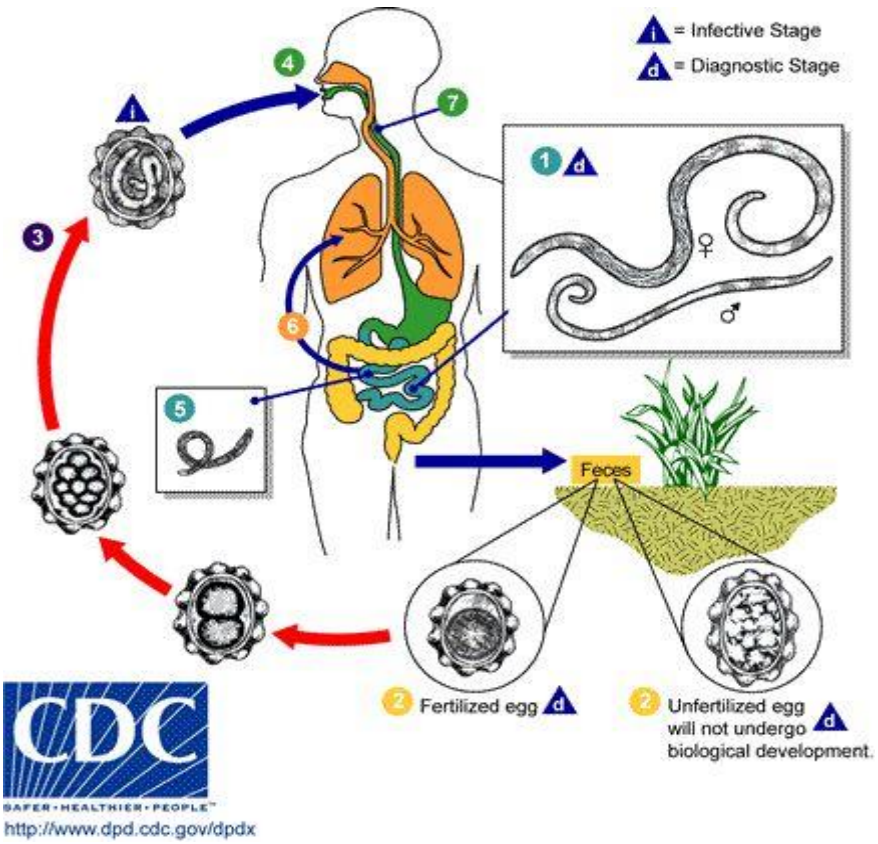


Figure (22): Life cycle of of *Ascaris lumbricoides*

Clinical features and pathology:

- During their heart-lung migration, cause inflammatory and hyper sensitivity reactions.

- When they in the intestine, they cause abdominal pain, nausea, diarrhoea and vomiting.
- If heavy infections, cause obstructions in the intestine, bile duct, and pancreatic duct.

Laboratory diagnosis:

1- By finding eggs in faeces by the direct saline preparation.
2- Identifying A. lumbricoides worms expelled through the anus or mouth.

Morphology:

C. Egg:

3. Fertilized egg: yellow-brown and the shell is covered by an albuminous coat. Oval or round measures 60x40 µm. contains a central granular mass which is an unsegmented fertilized ovum.

4. Unfertilized egg: occasionally found. Darker in colour, more elongated.

D. A. lumbricoides worm:
Large, female measures 20-35 cm long.

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2- Enterobius Vermicularis

Called the thread worm and pinworm, causes enterobiasis.

Distribution:

World wide.

Habitat:

Adult worm in small intestine.

Egg deposited in the peri-anal skin.

Infective larvae: during night when eggs hatch on the buttock.

:Morphology

Adult: male measures about 4 mm in length with curved tail .and spicules

Female: measures about 10 mm in length, with straight and .pointed tail

Egg: asymmetric colorless and flattened from one site, measures about 55-25 µm.

Transmission and life cycle (Figure 23):

1- Ingestion of infective egg.
2- Infection is easily transmitted by contaminated bed or clothes.
3- Autoinfection when egg hatches on the buttocks.

4- Infective larvae migrate back to the intestine.

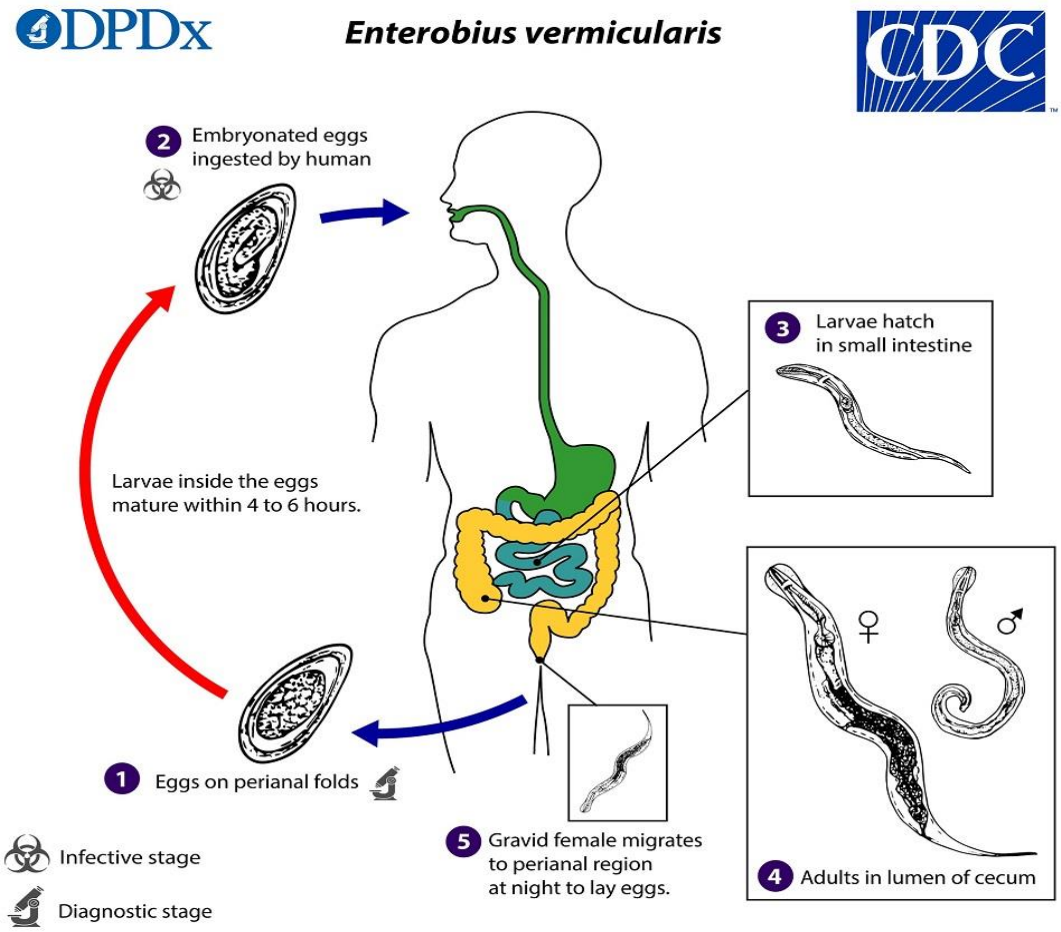

Figure (23): Life cycle of of *Enterobius vermicularis*

Gravid adult female *Enterobius vermicularis* deposit eggs on perianal folds ❶ . Infection occurs via self-inoculation (transferring eggs to the mouth with hands that have scratched the perianal area) or through exposure to eggs in the environment (e.g. contaminated surfaces, clothes, bed linens, etc.) ❷ . Following ingestion of infective eggs, the

larvae hatch in the small intestine [3] and the adults establish themselves in the colon, usually in the cecum [4] . The time interval from ingestion of infective eggs to oviposition by the adult females is about one month. At full maturity adult females measure 8 to 13 mm, and adult males 2 to 5 mm; the adult life span is about two months. Gravid females migrate nocturnally outside the anus and oviposit while crawling on the skin of the perianal area [5] . The larvae contained inside the eggs develop (the eggs become infective) in 4 to 6 hours under optimal conditions [1] .

Rarely, eggs may become airborne and be inhaled and swallowed. Retroinfection, or the migration of newly hatched larvae from the anal skin back into the rectum, may occur but the frequency with which this happens is unknown.

Pathology:

Rarely causes serious disease, usually intense irritation around the anus. In female infection of urinary and genital tract may occur. Worms in appendix may cause appendicitis.

Diagnosis:

1- By finding the egg in samples collected from perianal skin using adhesive tape, or recovered from clothing during the night.
2- Egg can also be found in stool but this is less commonly.

3- By finding the adult (female only) worm in faeces or during clinical examination (occasionally less that 10% of cases).

3-Hook worm.

Ancylostoma duodenale.

Necator americanus.

Distribution:

Tropics and sub-tropics, worm areas. Necator americanus is more common than Ancylostoma duodenale.

Habitat:

Adult worm in small intestine.

Egg in faeces but not infective.

Infective larvae: free in soil and water.

Transmission and life cycle (Figure 24):

1- Infection occurs when infective filariform larvae penetrate the skin.

2- Then larvae follow heart-lung migration.

3- Adult in small intestine.

4- Egg passed in faeces.

5- Larvae hatches from egg under favorable condition.

5- Develop into rhabditiform larvae, which develop into infective filariform larvae.

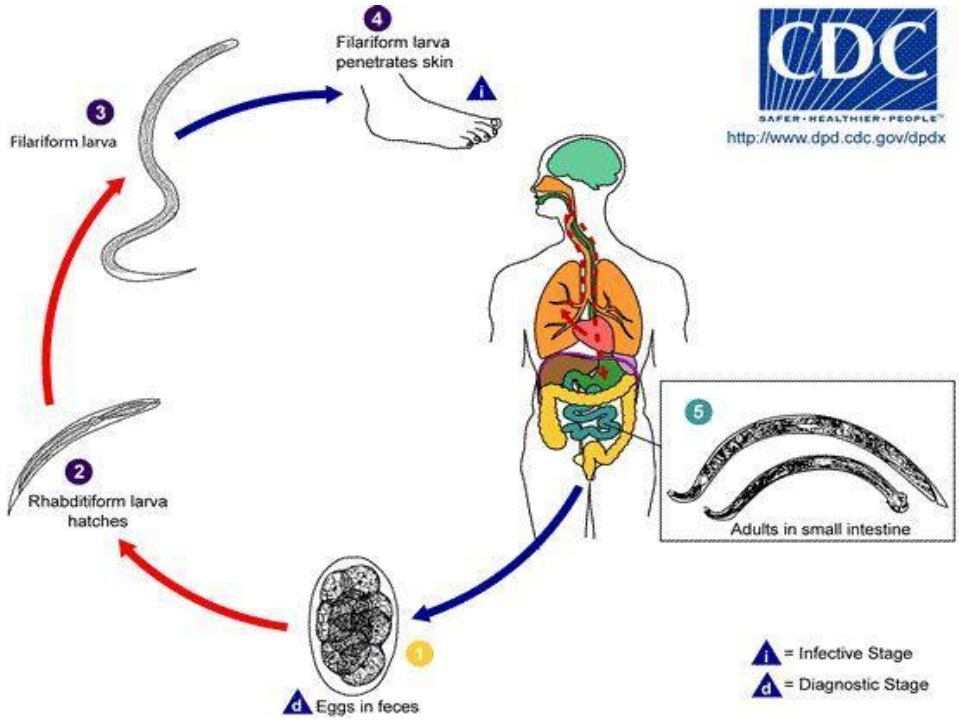

Figure (24): Life cycle of of *Ancylostoma duodenale*

Eggs are passed in the stool ❶ , and under favorable conditions (moisture, warmth, shade), larvae hatch in 1 to 2 days and become free-living in contaminated soil. These released rhabditiform larvae grow in the feces and/or the soil ❷ , and after 5 to 10 days (and two molts) they become filariform (third-stage) larvae that are infective ❸ . These infective larvae can survive 3 to 4 weeks in favorable environmental conditions. On contact with the human host,

typically bare feet, the larvae penetrate the skin and are carried through the blood vessels to the heart and then to the lungs. They penetrate into the pulmonary alveoli, ascend the bronchial tree to the pharynx, and are swallowed 4 . The larvae reach the jejunum of the small intestine, where they reside and mature into adults. Adult worms live in the lumen of the small intestine, typically the distal jejunum, where they attach to the intestinal wall with resultant blood loss by the host 5 . Most adult worms are eliminated in 1 to 2 years, but the longevity may reach several years.

Some *A. duodenale* larvae, following penetration of the host skin, can become dormant (hypobiosis in the intestine or muscle). These larvae are capable of re-activating and establishing patent, intestinal infections. In addition, infection by *A. duodenale* may probably also occur by the oral and the transmammary route. *A. ceylanicum* and *A. caninum* infections may also be acquired by oral ingestion. *A. caninum*-associated eosinophilic enteritis is believed to result following oral ingestion of larvae, not percutaneous infection. *N. americanus* does not appear to be infective via the oral or transmammary route.

Pathology:

1- The first sign is skin reaction at the site of penetration.
2- Mild respiratory symptoms.
3- Adult hookworm causes chronic blood loss leading to developing iron deficiency anaemia in prolonged infection.

Morphology:

Diagnosis:

1- Finding hookworm egg in faeces by direct or concentration technique.

Egg: oval 60X40 µm. colorless with thin shell.

Adult:

2- In old stool sample larvae may hatch.

https://youtu.be/J-euUNCk-5g

https://youtu.be/Wuk4VV77T1g

https://youtu.be/dyprqPM1rHI

https://youtu.be/OF10ANqNMWs

https://youtu.be/R9Zp5zvO6Zs

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https://youtu.be/3YoDQiE8buc

https://youtu.be/FZySr71KveU

https://youtu.be/Vh7IDPKdSeg

References:

1- Doss, Mildred A. *Index Catalogue of Medical and Veterinary Zoology: Trematoda,* Parts 1–8. Washington, DC: U. S. Government Printing Office, 1966.

2- Olsen, O. Wilford. *Animal Parasites: Their Biology and Life Cycles.* Minneapolis: Burgess Publishing Co., 1967.

3- Schell, Stewart C. *How to Know the Trematodes.* Dubuque, IA: William C. Brown Co., Publishers, 1970.

Protozoan parasites

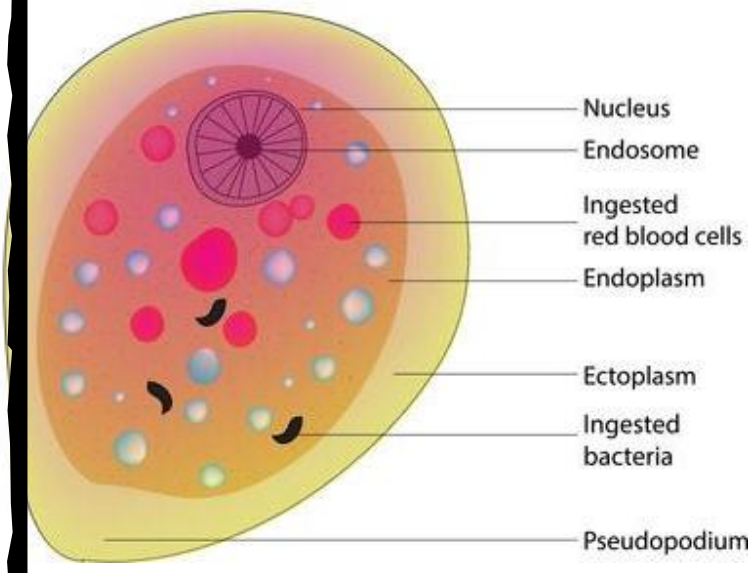
Entameoba histolytica

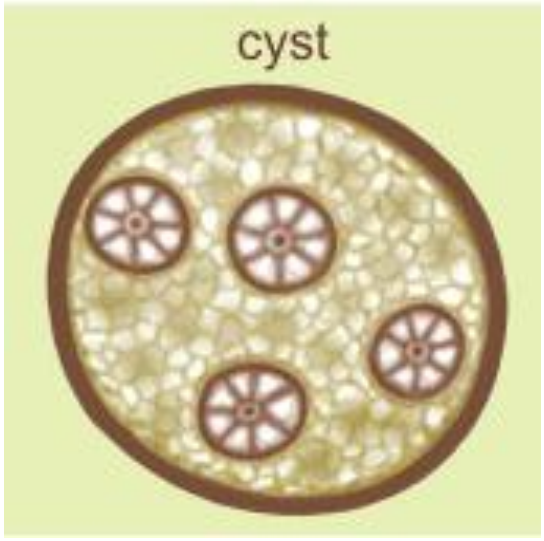
Kingdom : Animalia

Phylum : Protozoa

Class : Sarcodina

e.g. : Entameoba histolytica





Habitat: large intestine

Host : definitive host (man) Intermediate host (none)

Infective stage : mature cyst (contain 4 –nuclei)

Flagellated protozoan parasites

Types of flagellates according to normal habitat
1- intestinal species

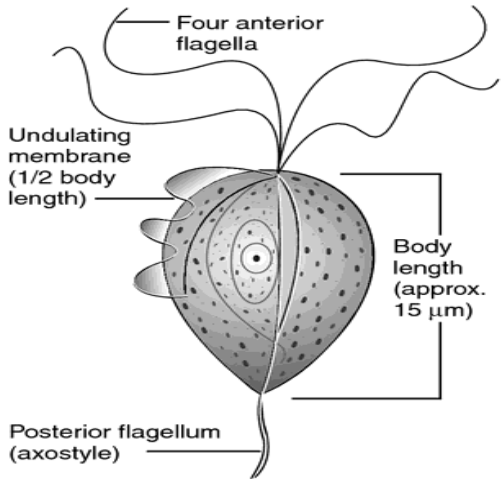
Trichomonas hominis

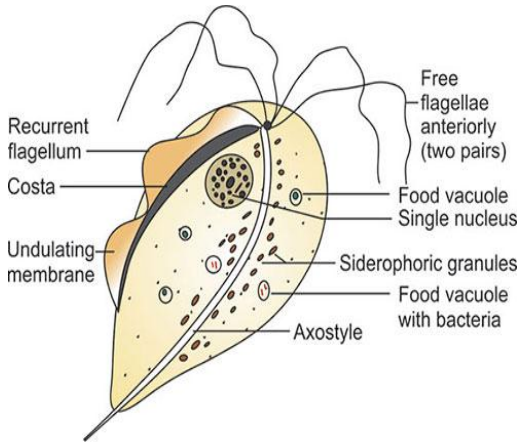
Kingdom : Animalia

Phylum : Protozoa

Class : Mastigophora

e.g. : Trichomonas hominis





Habitat: large intestine especially caecum of human

Host : definitive host (man) Intermediate host (none)

Infective stage : Trophozoite

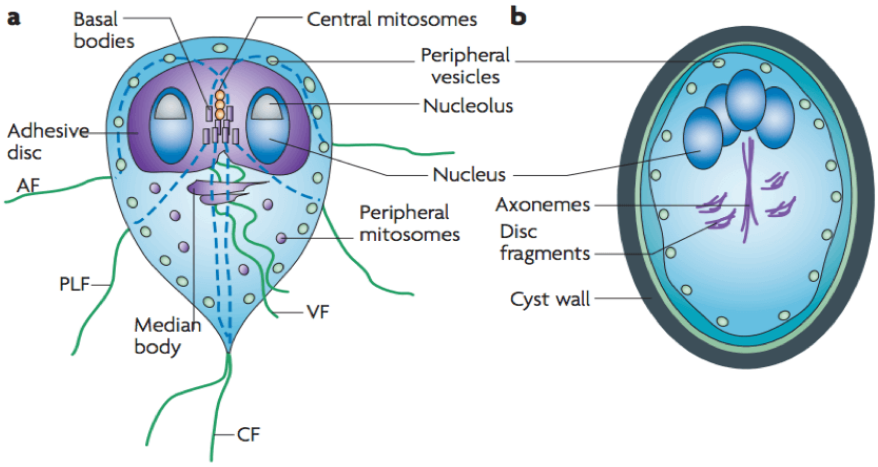
Giardia lamblia

Kingdom : Animalia

Phylum : Protozoa

Class : Zoomastigophora

e.g. : **Giardia lamblia Kofoid**



Habitat: Trophozoite: in the upper part of the small intestine, especially in the children. Also in faesec after laxative and diarrhea.

Host : definitive host (human). Intermediate host (none)

Infective stage : the infected form (cyst)

2- blood and tissue species

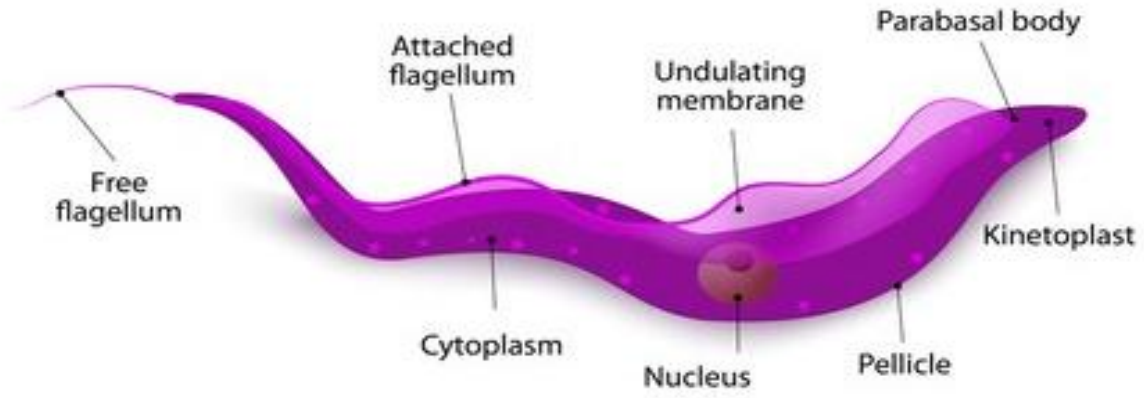
Trypanosoma sp.

Kingdom : Animalia

Phylum : Protozoa

Class : Mastigophora

e.g. : Trypanosoma sp.



Habitat: blood stream

Host : definitive host (human)

intermediate host (Tse – Tse fly)

recevoir host (pigs)

Infective stage : metacyclic stage

3- urogenital species

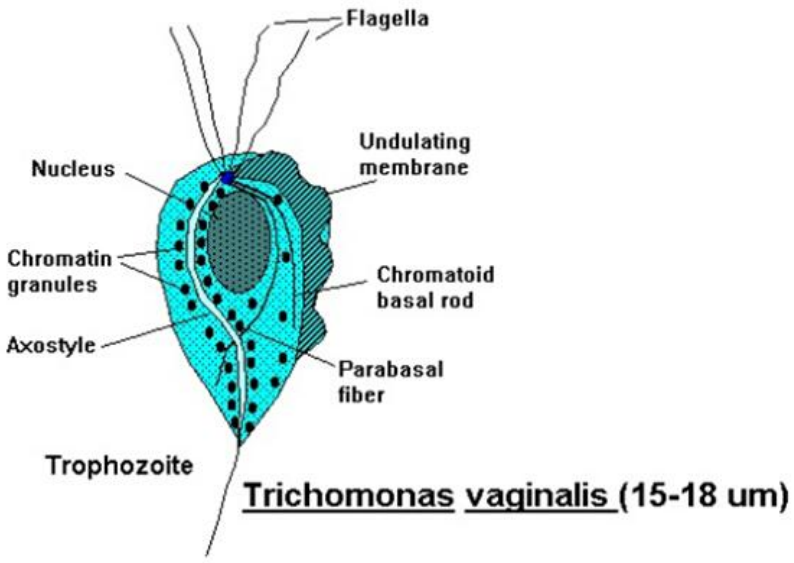
Trichomonas vaginalis

Kingdom : Animalia

Phylum : Protozoa

Class : Mastigophora

e.g. : Trichomonas vaginalis



habitat : in the genital tract of women and man (prostate)
hosts : definitive host (human) intermediate host (none)
infective stage : trophozoite

Ciliated protozoan parasites

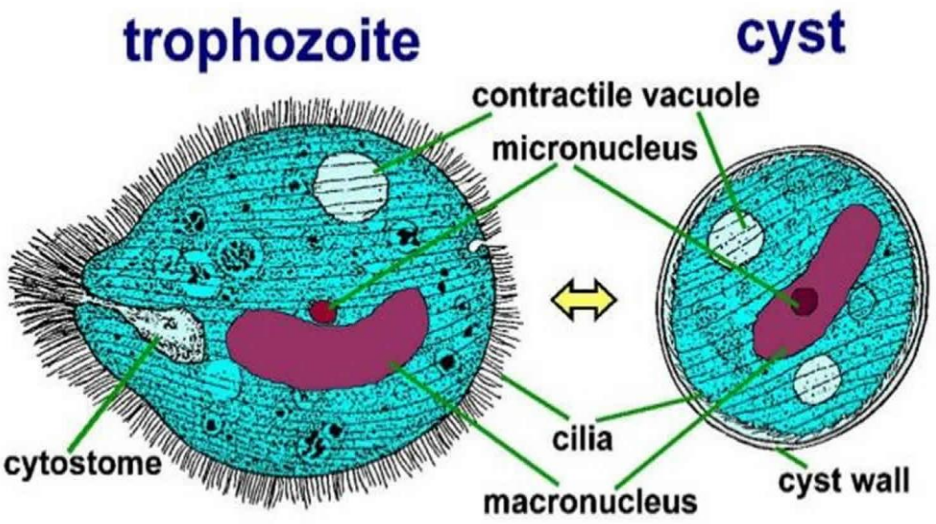
Balantidum coli

Kingdom : Animalia

Phylum : Protozoa

Class : cliophora

e.g. : Balantidum coli



Habitat: large intestine

Host : definitive host (human)

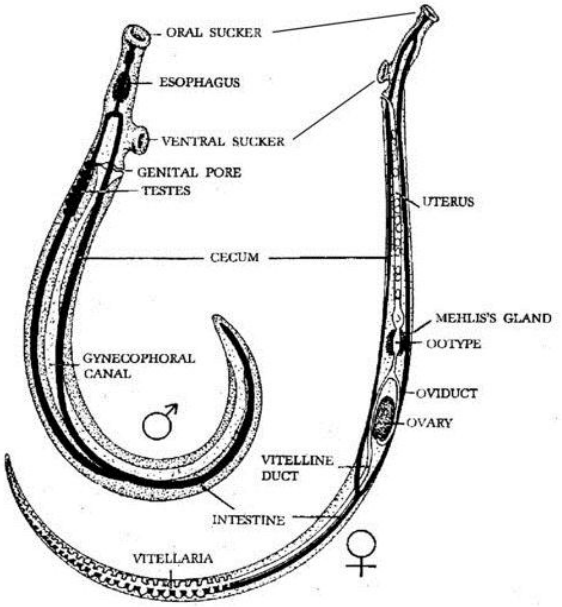
Intermediate host (none) Receiver host (pigs)

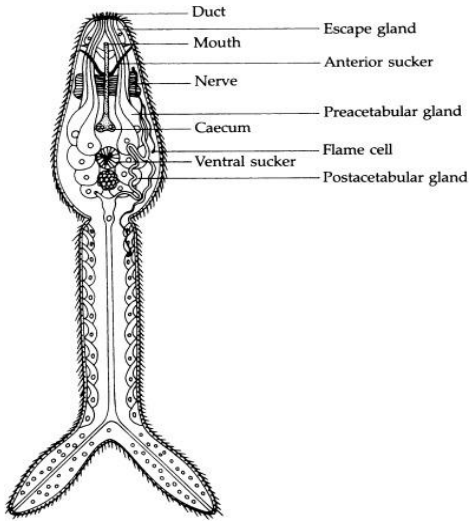
Infective stage : cyst

platyhelminthes Helminthes

Schistosoma haematobium

Kingdom : Animalia
Subkingdom : Eumetazoa
Phylum : Platyhelminthes
Class : Trematoda
Subclass :Digenea
Family : Schistosomatidae
e.g. : Schistosoma haematobium





Habitat: adults (Hepatic portal veins).

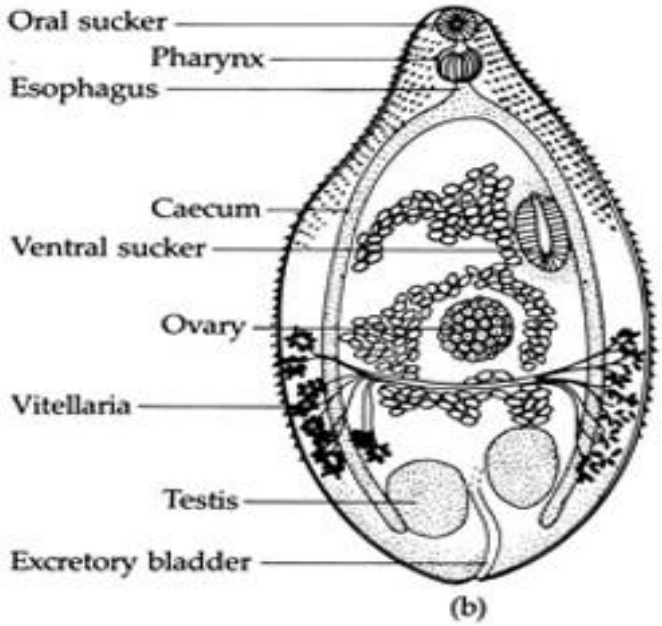
oviposition (venules of urinary bladder).

Hosts : definitive host (man). intermediate host (Bulinus truncatus) reservoir host (monkeys).

Infective stage : furcocercous cercariae

Heterophyes heterophyes

Kingdom : Animalia
Subkingdom : Eumetazoa
Phylum : Platyhelminthes
Class : Trematoda
Subclass :Digenea
Family :Heterophyidae
e.g. : Heterophyes heterophyes



Habitat: small intestine .

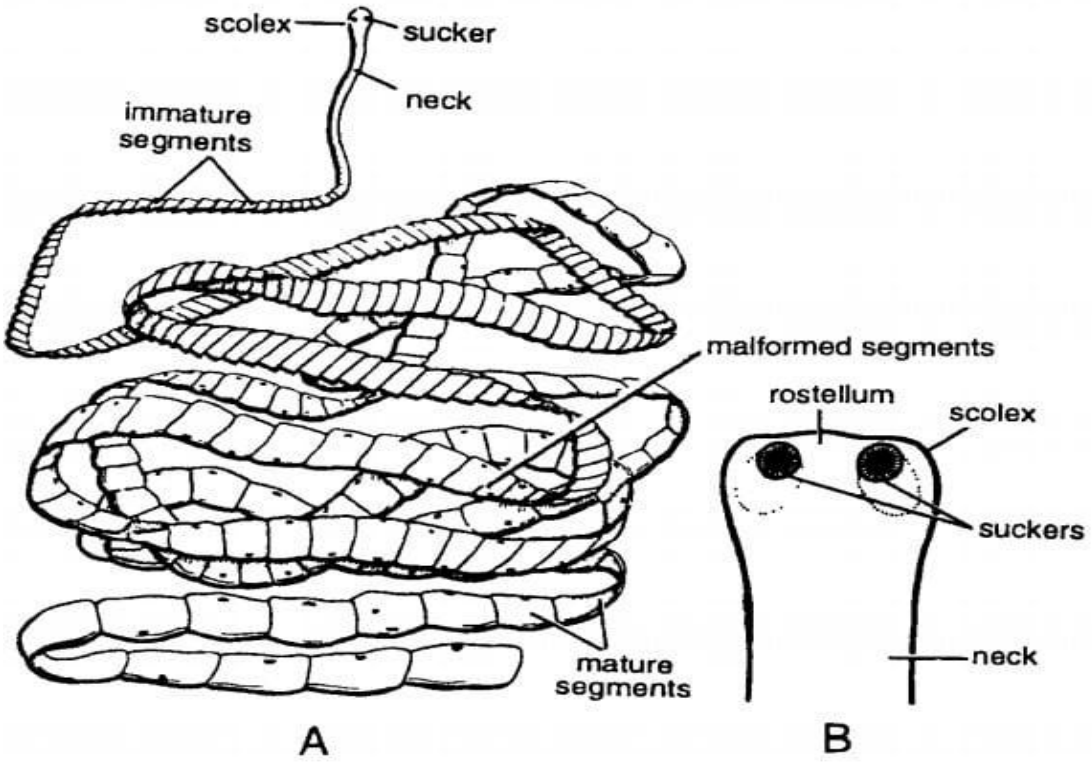
Hosts : definitive host (man) .

intermediate host : snail (first intermediate host) Pironella conica and (second intermediate host) is fish from freshwater or brackish water containing metacercariae (encysted stage).

Infective stage : metacercariae

Taenia saginata

Kingdom : Animalia
Subkingdom : Eumetazoa
Phylum : Platyhelminthes
Class : Cestada
Order :C yclophyllidae
Family : Taenidae
e.g. : Taenia saginata



Taenia saginata. **A.** Entire, **B.** Scolex with neck greatly enlarged.

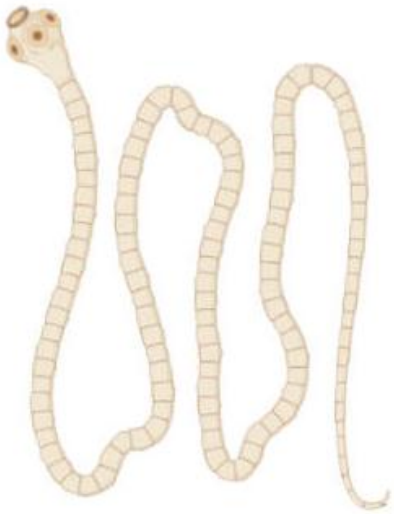
Habitat: small intestine

Hosts : definitive host (man) intermediate host (cows)

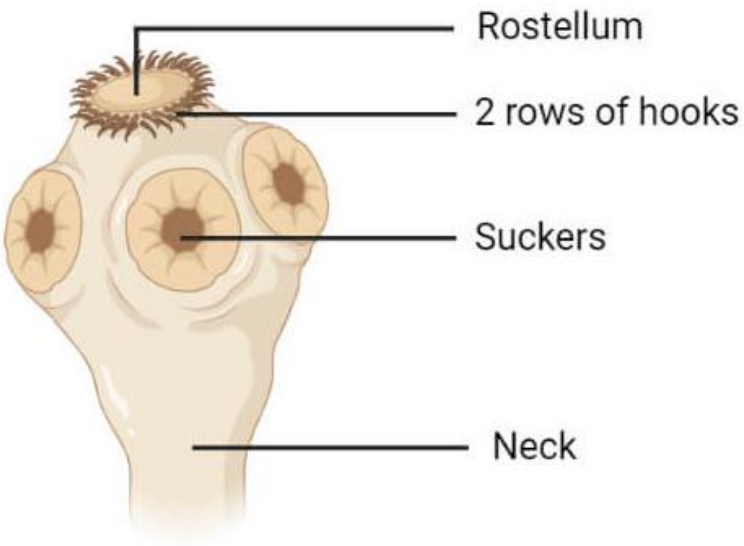
Infective stage : bladder worm

Taenia solium

Kingdom : Animalia
Subkingdom : Eumetazoa
Phylum : Platyhelminthes
Class : Cestada
Order :C yclophyllidae
Family : Taenidae
e.g. : Taenia solium



Adult *Taenia solium*



Scolex

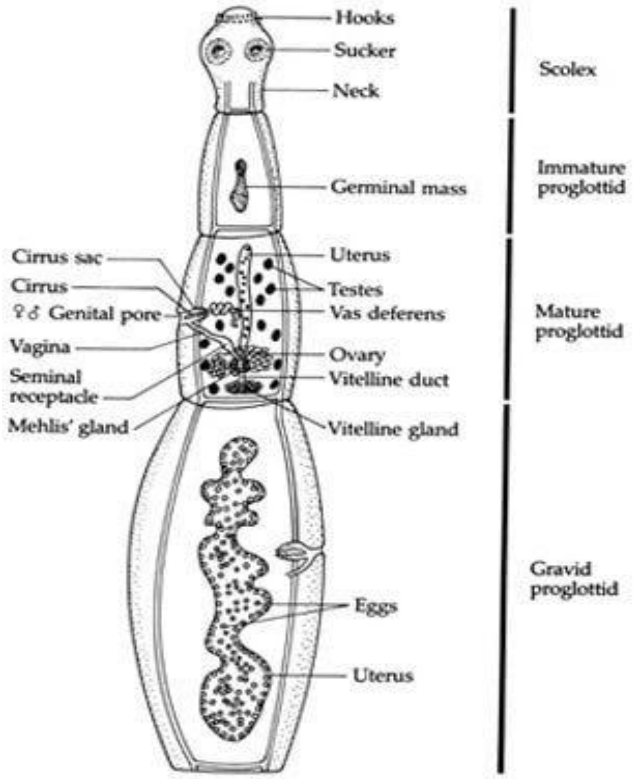
habitat : small intestine

Hosts : definitive host (man) intermediate host (pigs)

Infective stage : bladder worm

Echinococcus granulosus

Kingdom : Animalia
Subkingdom : Eumetazoa
Phylum : Platyhelminthes
Class : Cestada
Order :C yclophyllidae
Family : Taenidae
e.g. : Echinococcus granulosus



Habitat : small intestine

Hosts : definitive host (dogs and foxs)

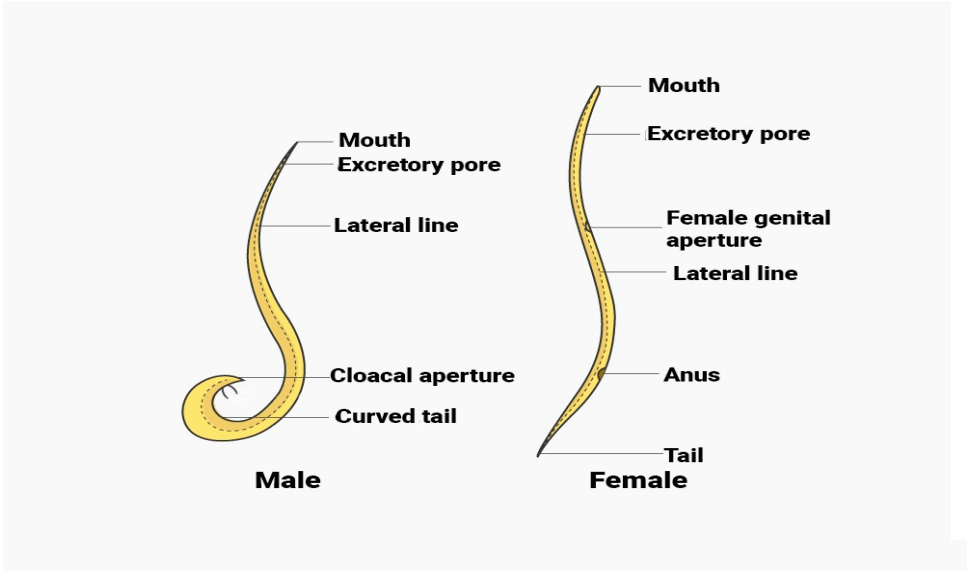
intermediate host (pigs and maybe man)

infective stage : hydatid cyst

Aschelminthes

Ascaris vitulorum

Kingdom : Animalia
Subkingdom : Eumetazoa
Phylum : Aschelminthes
Class : Nematoda
Order : Ascaridata
Family : Ascaridae
e.g. : Ascaris vitulorum



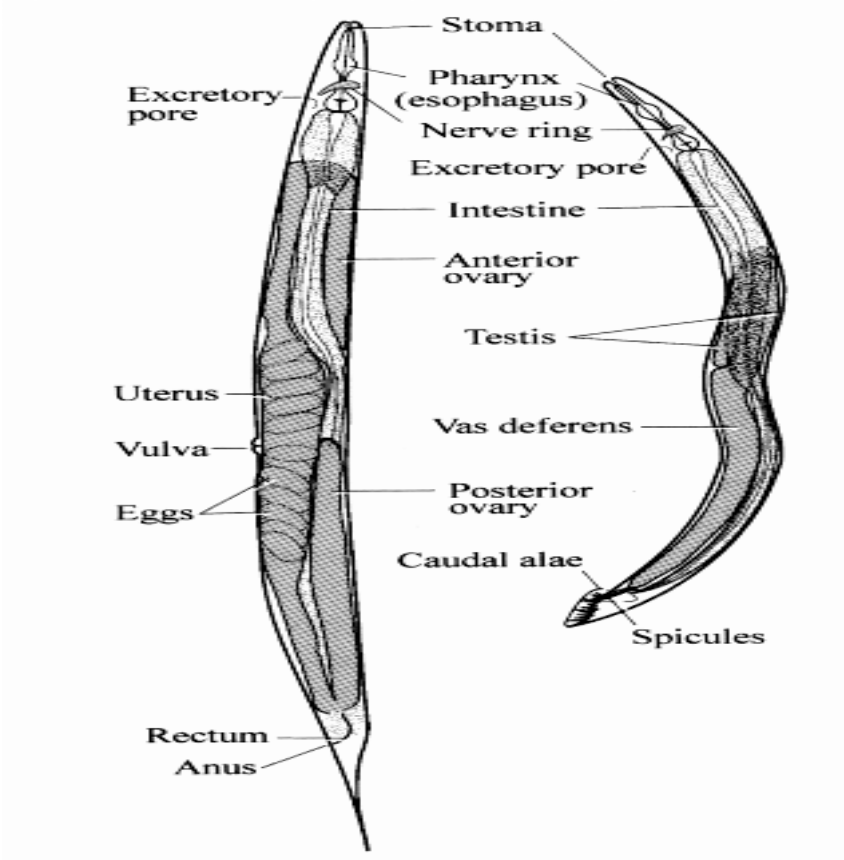
habitat : small intestine

hosts : definitive host (cows) intermediate host (none)

infective stage : embryonate egg

Enterobius Vermicularis

Kingdom : Animalia
Subkingdom : Eumetazoa
Phylum : Aschelminthes
Class : Nematoda
Order : Oxyurata
Family : Oxyuridae
e.g. : Enterobius Vermicularis



Habitat : large intestine , specially colon and appendix

Hosts : definitive host (man) intermediate host (none)

Infective stage : embryonate egg

Ancylostoma duodenale

Kingdom : Animalia
Subkingdom : Eumetazoa
Phylum : Aschelminthes
Class : Nematoda
Order : Strongylata
Family : Ancylostomatidae
e.g. : Ancylostoma duodenale

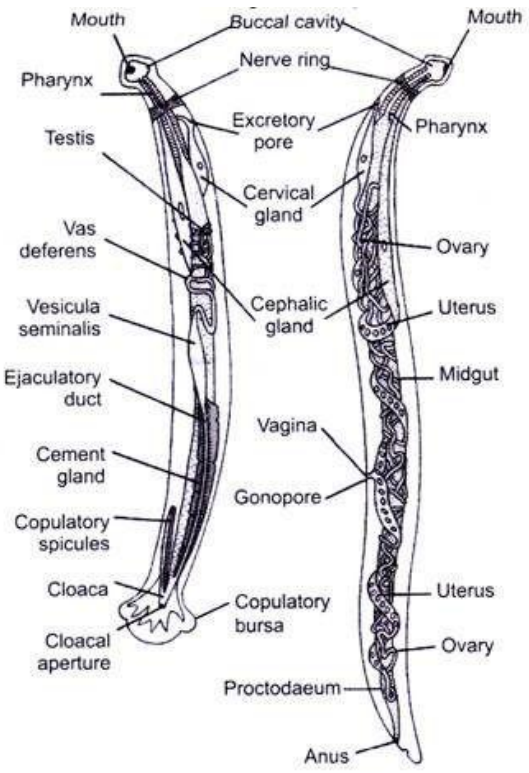


Fig. 9.20 Male and Female *A. duodenale*

habitat : small intestine

Hosts : definitive host (man) intermediate host (none)

Infective stage : filariform larvae

Course Name: Zoology 7

B-Part:

ENTOMOLOGY:
CLASSIFICATION OF THE INSECTS

Graduate: Fourth year, Division of Biology and Geology, in English

Professor of the course: Prof. Dr. Khaled S. M. Osman

Prof. Dr. Hoda S. Mohamadien

Department of Zoology-College of Science

Academic Year

2022-2023

Faculty: Education

Graduate: Fourth Graduate

Specialization: Biology and Geology in English

Number of pages: 112 pages

The department to which the course belongs: General Education, Biology and Geology, in English

Contents

A- Entomology

Contents

List of Figures

List of Tables

1.Preface

Insects are one of the classes of arthropod animals, and insects gained their importance as they are the most common on earth among living organisms as well as the effective positive and negative their impact on humans, animals and plants. Therefore, it is important to study an insect including different aspects. This note will present an introduction to entomology. In general, we will study the importance of insects spiritually, scientifically and economically. Moreover, it includes the general characteristics of insects. The morphology of insects in different body regions will be involved in the current preliminary study. We will present brief notes on the internal anatomy of insects of some body systems. Furthermore, we'll show an introduction to classification of insects and some orders. Finally, hope you my students benefit and enjoy studying this scientific materials.

Prof. Dr.

Khaled S. M. Osman

2021-2022

الرموز المستخدمة


فيديو للمشاهدة.


نص للقراءة والدراسة.

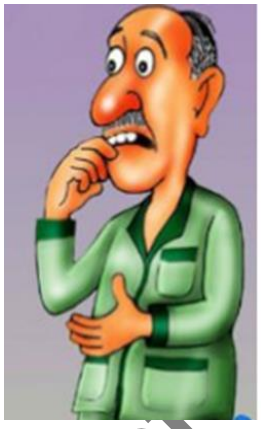

رابط خارجي.


أسئلة للتفكير والتقييم الذاتي.


أنشطة ومهام.


تواصل عبر مؤتمر الفيديو.

2. Why we care about insects?!!!



2.1. Firstly:

For their spiritual significance

The mosquitoes mentioned in the Holly Books……

1. **House Flies**
2. **Termites**
3. **True Ants**
4. **The Bees**
5. **Locusts**
6. **Louse**

mentioned in the Holly Books

2.2. Secondly:
For their scientific importance

A- Insect Ratio

Class: Insecta is a class of phylum Arthropoda

Phylum Arthropoda is a phylum of Kindom Animalia

Kindom Animalia is one of 5 kingdoms that are:

1. **Monera – including……?? complete**
2. **Protista – including……?? complete**
3. **Animalia – including……?? complete**
4. **Plantae – including……?? complete**
5. **Fungi ……including……?? complete**

Species of class insects represent 50.2 % of all being organisms

Moreover, they represent 72% of all animals

B-Tolerance

They live in all environments

***Hot wells آبار حارة**

***The two earth poles**

***Temperature and Hinton 1960 experiment**

University of Florida Book of Insect Records

Chapter 4 *Most Tolerant of Cold*

JASON P.W. HALL

Department of Entomology & Nematology
University of Florida, Gainesville, Florida 32611-0620

1 May 1994

In laboratory tests, Hinton (1960) found that dehydrated larvae of the African chironomid Polypedilum vanderplanki *(Diptera) could survive submersion in liquid helium (-270 C). This phenomenon seems related to its ability to tolerate extreme desiccation.*

The aim of this paper is to identify the insect species most tolerant to cold. 'Most tolerant to cold' is here taken to mean ability to survive the lowest temperature. The search was an open ended one, such that the results could come from individuals studied under natural or laboratory conditions.

Methods

I first searched the secondary literature, such as general ecology, entomology and physiology textbooks. All author's names associated with work on cold tolerance were then subjected to a literature search. The Agricola data base 1970-1993, was also searched for reference to papers on cold tolerance in insects.

subjected to repeated dehydration, and accordingly *P. vanderplanki* has evolved the capacity to tolerate severe desiccation in an anhydrobiotic state. It seems likely that it is due to this phenomenon that the insect is able to survive extreme temperatures. Hinton (1960) placed the larvae directly in liquid helium from room temperature. Only larvae that had been desiccated to a water content of 8% survived freezing at -270 C and subsequently metamorphosed, after warming and rehydration. When frozen fully hydrated, the larvae failed to recover, apparently because of damage to the fat body (Leader 1962). In contrast, elimination of body water in freezing-tolerant nonanhydrobiotic species can often be detrimental to the chances of survival at low temperatures (Salt 1961).

The lowest temperature survived by any insect in a nonanhydrobiotic state is -196 C by the prepupae of the sawfly *Trichiocampus populi*. Tanno (1968) employed a three step procedure consisting of freezing the prepupae at -20 C, transferring them to -5 C for several hours and

Fig. (1): ***Adults of Polypedilum vanderplanki***

Fig (2): ***Larva of Polypedilum vanderplanki***

***Humidity or moisture**

***pH**

***Salinity**

***Oil wells of Petroleum**

an insect

2.3. Thirdly:

For the Economic importance

A- Insect Dangers

A- On Human

1- Annoyance pest

Insects Annoyance as Pests

2-Vectors of Disease Pathogens

Fig (4): ***Aedes feeding on its host***

B- On Animals: Causing diseases ……. Causing disturbance

C- On Plants: For Leaves - For Stems - For Roots

A- Dangers of the Insects
On Plants
Pulvinaria tenuivalvata*, *Sesamia cretica **and** ***Gryllotalpa africana*** **attack certain plan Leaves, stems and roots, respectively.**

Benefits of the Insects

I- Benefits of the Insects to Human

A) Production of natural, Medical and

Industrial substances or products

B) Insects as food

C) The insect and the scientific Researches

D) The insects and the Arts

Benefits Bee Honey on digestive System Treatment of Digestive upset اضطرابات المعدة, hepatitis, cholecytitis التهاب المرارة, gingivitis التهاب اللثة, tooth decay تسوس الأسنان

Fig. (6): *Tooth decay*

Benefits on skin: Benefits to epidermis, Analgesic against pain of burns and wounds

Benefits on Circulatory System: Raising the ratio of hemoglobin, treatment Anemia and strengthen the heart muscles.

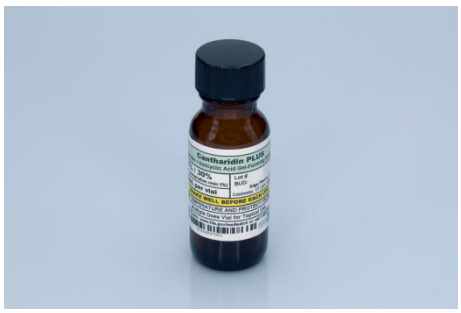
Benefits on Respiratory System: Expectorant طارد للبلغم, Treatment of cough علاج السعال and Pneumonia الالتهاب الرئوى

Benefits onNervous System: Treatment of nervous headache, Polio strengthen eyesight, heal corneal , ulcers, and infections يقوي النظر، ويشفي به تقرحات القرنية, Genital system and increases the energy and sexual strength

A2-Cantharidin: from blister beetles: It is a burn agent or a poison in large doses and for treating molluscum contagiosum that caused by a virus of the skin وقد استخدمت كأدوية موضعية فعالة لعلاج عدوى الجلد الناجم عن فيروس

A3- Allantoin: It is an anti-septic مطهر produced by some larvae of some flies
A4- Carmine dye: Carmine also is called cochineal, cochineal extract of *Dactylopius coccus*,الحشرة القشرية القرمزية , natural red dye, E120, is a pigment of a bright-red color obtained for coloring red medicaments.

Dactylopius coccus



Cantharidin ***Bee Honey***

Fig (7): ***Insects and their products***

Lac: secreted by some scale insects

Silk: from *Bombyx mori* (Silk worm)

Fig (8): ***Cocoons from a silk production factory in Wuhan, China. (Photograph by Leellen Solter.)***

شرانق من مصنع لإنتاج الحرير في ووهان، الصين. (تصوير ليلين سولتر).

I- Benefits of the Insects to Human

B) Insects as food:

Eggs of *Lethcerus niloticus*, *Gryllus bimaculatus* and *Schistocerca grigaria* or Locusts

C) The Insects and the researches

D) The insects and the Arts

Fig (9): ***Thai market selling deep-fried insects (anticlockwise left, front): locusts, bamboo-worms, moth chrysalis, crickets, scorpions, and diving beetles***

سوق تايلاندي يبيع الحشرات المقلية (عكس اتجاه عقارب الساعة إلى اليسار ، من الأمام): الجراد ، وديدان الخيزران ، وعثة الشرنقة، والصراصير ، والعقارب ، وخنافس الغوص

Fig (10): ***Hollywood uses darkling ground beetle to produce works of art*.**

تستخدم هوليوود السلوكيات الجوهرية للحشرات مثل خنفساء الأرض الداكنة لإنتاج أعمال فنية.

Fig (11): ***Live death-watch beetles adorned as living jewelry in market in Mexico. (Photograph by Susan Post.)***

خنافس ساعة الموت الحية مزينة كمجوهرات حية في السوق في المكسيك. (تصوير سوزان بوست.)

Honey Bee

Paederus fuscipes

Blister beetle

Cochineal insect

Cochineal insect

Calliphora vicina

Hualophora cecropia

Fig (12): ***Some economic insects***

B- Benefits of the Insects on plants: Pollens transmitting of about 3000 plant species and the insects as biological control in instance *Tichogramma* sp.

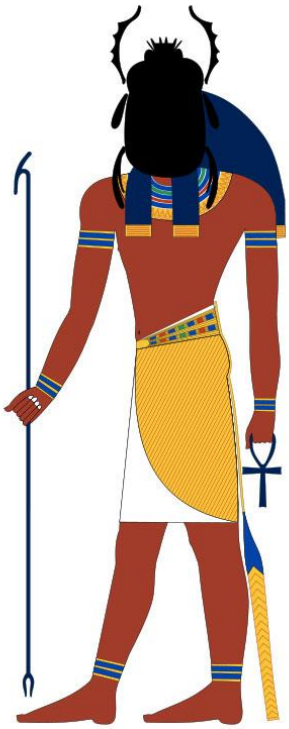
3. INTRODUCTION TO INSECT TAXONOMY

Class: Insecta

3.1. History of Insect Taxonomy

History of Insects in ancient Egyptian people:
Egyptian Mythology الأساطير المصرية
- Scarab (dung) beetle

Scarab (dung) beetle



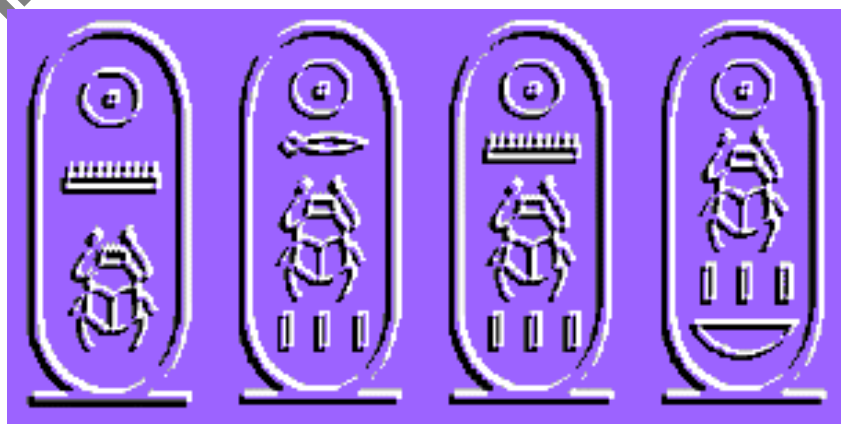


Fig (13): ***Ancient Egyptian typing referring to Scarab (dung) beetle***

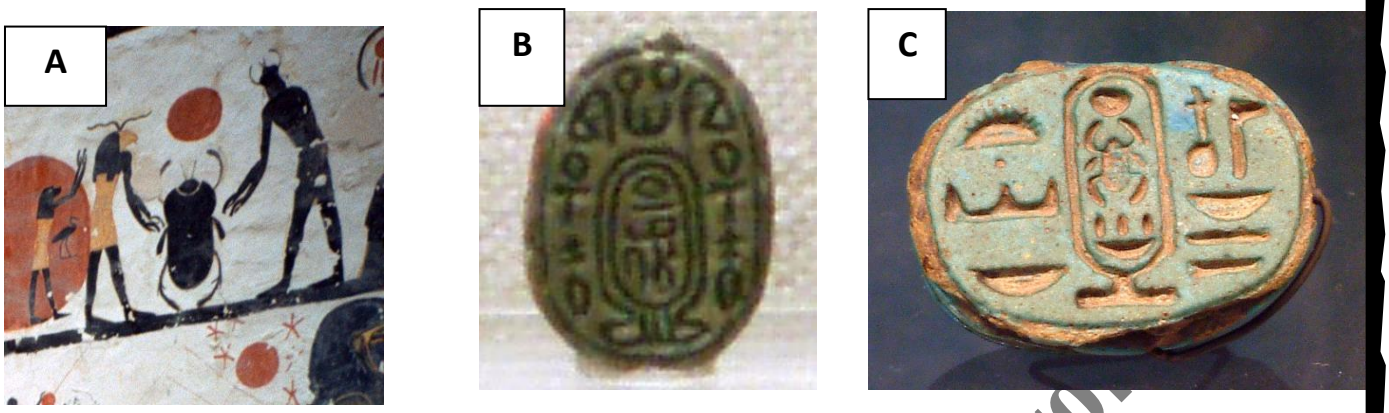


Fig (14): ***A)Egyptian scarab from Tomb 6 in the Valley of the Kings, B)A seal in the form of a ring bearing a cartouche with the name of Tutankhamun and C)Scarab with cartouche written on it***

The scarab or scarab is a green ceramic vine in the shape of a dung beetle that the ancient Egyptians used to make for decoration. The scarab's shape is due to a black insect that has the habit of pelletizing carrion, dirt and dung, placing its eggs in it, rolling it in front of it and collecting it in its hole, then feeding on it to keep its eggs. The ancient Egyptians called it Khyber. And when writing began to appear, its image was used to write a complex word, which is the verb news, meaning (to come into existence), then it became in the sense of (to be) or (to become.

Among the strange images preserved in the Valley of the Kings, a huge black beetle emerging from the sand, pulling a glowing ball. Plutarch explains this - without apparently departing from the ancient Egyptian interpretation - and says: (As for the scarab beetle, it is believed that it has no females and all scarabs are males. This is the path of the sun from east to west).

https://ar.wikipedia.org/wiki/%D8%AC%D8%B9%D8%B1%D8%A7%D9%86_%D9%81%D8%B1%D8%B9%D9%88%D9%86%D9%8A

3.2. Insects Classification

Introduction

Over one million species have been described to date. The classification of insects is very important to group and identify insects.

3.2.1. Identification of Taxonomy

ا- تعريف علم التصنيف

Taxonomy is the science, studying identification and, classifying the being organisms into groups, that are similar to each other in some characters and are, different in others.

علم التصنيف هو العلم الذى يهتم بتعريف الأفراد و يقسمهم الى مجموعات تتشابه فى صفات و تختلف فى صفات أخرى

3.2.2. History of the Insect Taxonomy

ب- تاريخ علم تصنيف الحشرات

1- Linnaeus 1707:

- **He divided the insects to 7 orders, of them, order: Aptera**
- **that was included some arthropods not insects later**

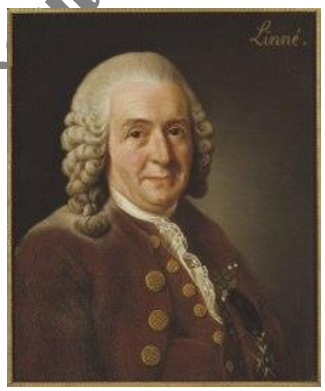


Fig (15): *Linnaeus*

Brauer 1885:

He established insect taxonomy according to: برایر هو مؤسس علم تصنيف الحشرات و قد قسم الحشرات على أساس Types of Mouth parts, Wings : present or absent الأجنحة و موجودة أم غائبة Thoracic segments: number and nature عدد و طبيعة عقل الصدر Number of Malpighian tubules عدد أنيبات ملبيجى Metamorphosis التحول فى الحشرات

He classified Class Insecta into: و بالتالى قسم طائفة الحشرات إلى

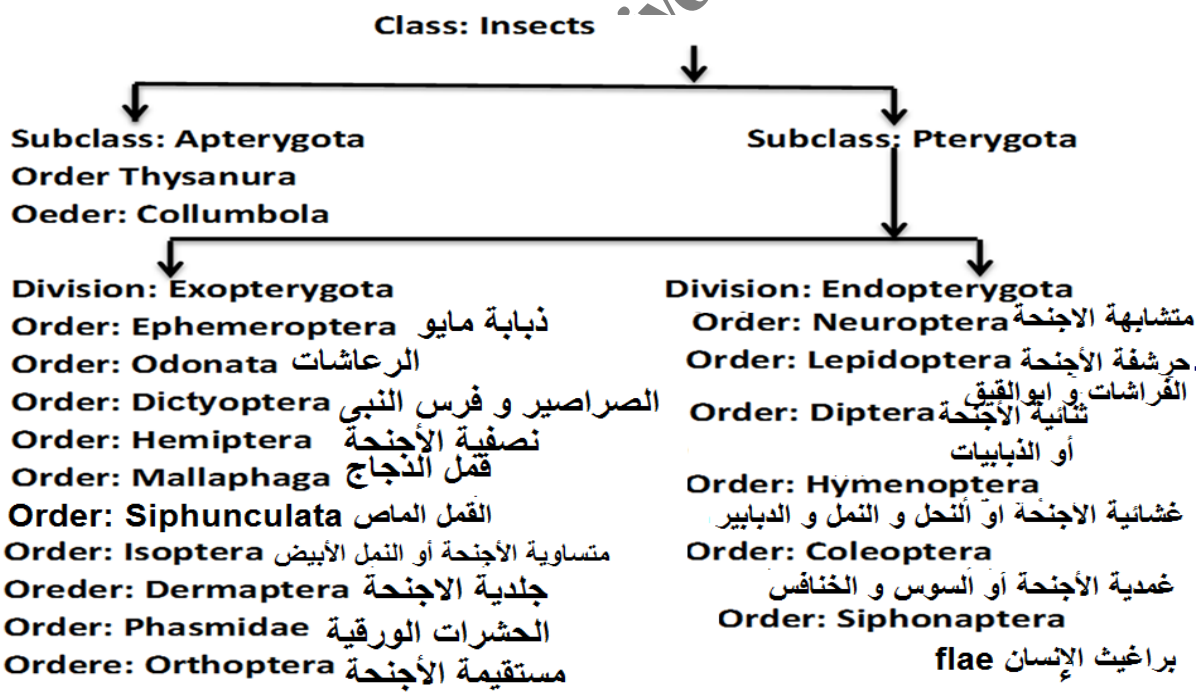
1. **Subclass: Apterygota** تحت طائفة: حشرات عديمة الأجنحة
2. **Subclass: Pterygota** تحت طائفة: الحشرات المجنحة

Sharp: 1899:

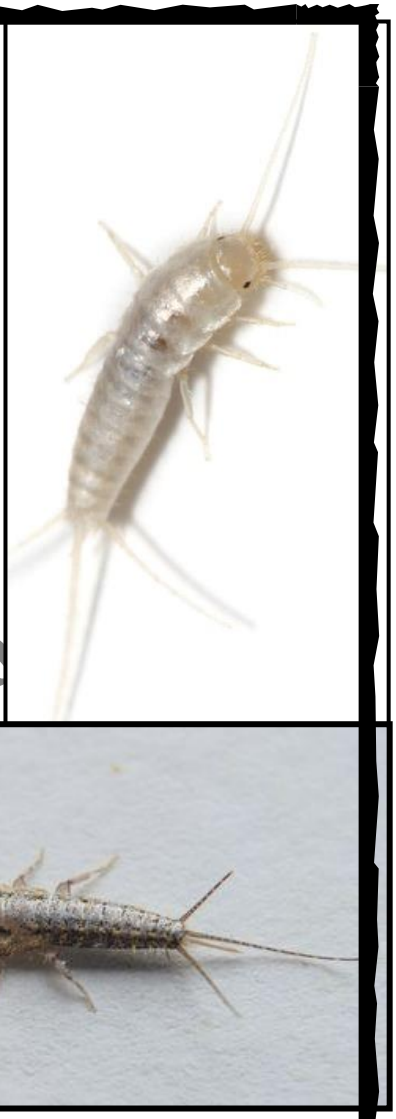
He Classified subclass: Pterygota into division: Exopterygota and Endopterygota. Depending on how the wing arisen (from external buds or internal buds.

3.2.3. Other Taxonomic Methods طرق أخرى للتصنيف **as genetic Taxonomy** علم التصنيف بعلم الوراثة, **ecological taxonomy** علم الصنيف بعلم البيئة **and Parasitic Tax.** علم الصنيف بعلم الطفيليات..... **and so on.....**

3.3. The General Insect Taxonomic Plan



Class: Insecta
Subclass: Apterygota
3.3.1. Order: Thysanura or Zygentoma
(*thysanos*=fringe; *uara*= tail)
Silver Fish
السمك الفضى



A- Habitats and Habitats:

*Some of them inhabit
— houses,
— books and
— starch,

*Under bark, or

*Included in the termite nests

Fig (16): A zygontomal insects

B- Morphology:

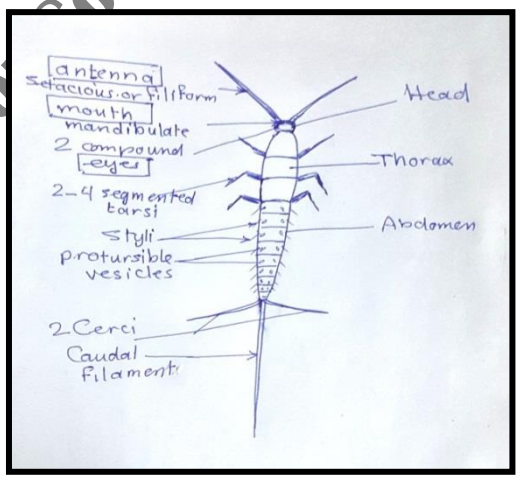


Fig (17): A draw showing a thysanuran specimen prepared by the current author

C- Taxonomy

Class: Insecta

Subclass: Apterygota

Order: Thysanura (Zygentoma)

Family: Lepismatidae

(exempli gratia in Latin),**e.g.**

Thermobia aegyptiaca (in books, houses and starch)

Lepisma saccharina (under bark)

Petrobius maritamus (included in termite nests)

D- Video on life of zygontoma

https://www.youtube.com/watch?v=IMYNN4ueiu0 **فيديو للمشاهدة**

Youtube on Sliver Fish movement:

https://www.youtube.com/watch?v=DneY1690DC0 **فيديو للمشاهدة**

3.3.2. Order: Collembola
Springtails
قافزة الذنب



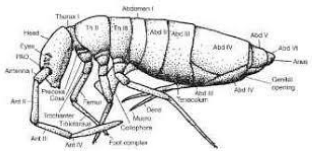



Fig (18): Collembolan specimens

A-Habitats Habitats:

They inhabit the wet places, beside the sea beach and among detritus

B-Morphology

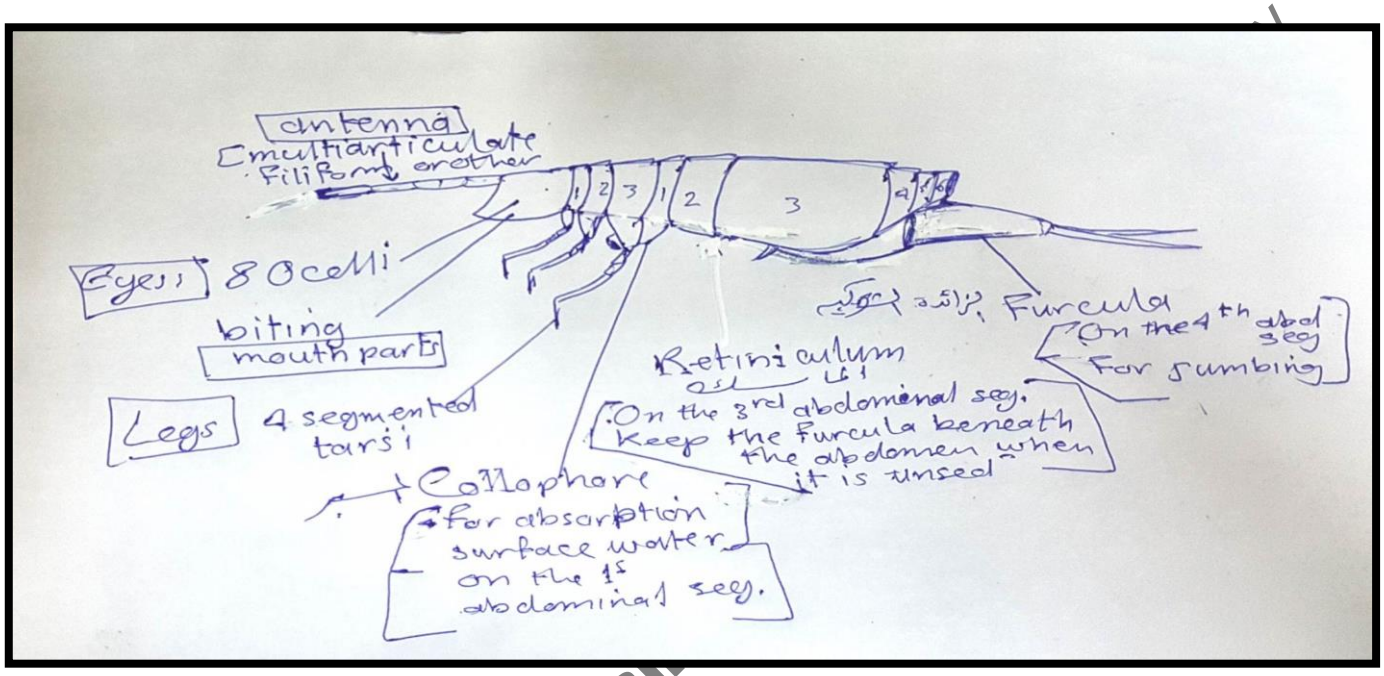


Fig (19): A draw showing a collembolan specimen prepared by the current author .

***Collophore** to stick to surfaces in order to stabilize the creature, ***Furcula** that is folded beneath the body to be used for jumping when the animal is threatened. It is held under tension by a small structure called the ***Retiniculum** (or tenaculum) when released, snaps against the substrate, flinging the springtail into the air. All of this takes place in as little as 18 milliseconds.

C-Taxonomy

Class: Insecta

Subclass: Apterygota

Order: Collembola

Family: Sminthuridae e.g *Sminthurus* sp.

Family: Entomobryiidae, e.g *Entomobrya* sp.

3.3.3. Order: Diplura ثنائية الذنب

Fig (20): A dipluran specimen

A-Habitats Habitats

They inhabit the wet places and among detritus

B-Morphology

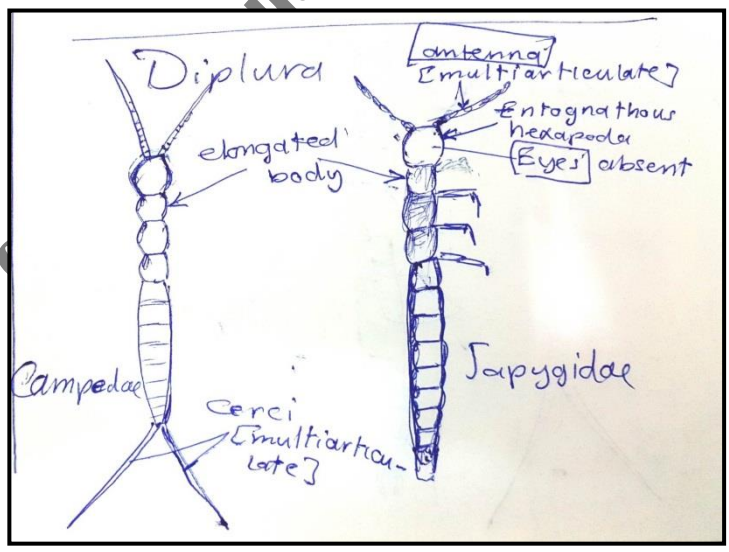


Fig (21): A draw showing dipluran specim-

ens prepared by the current author

C- Taxonomy

Class: Insecta

Subclass: Apterygota

Order: Diplura: Families: **Campedae and Japygidae**

D-Video on order Diplura

Youtube showing dipluran movement:

https://www.youtube.com/watch?v=83E3UGChPAE فيديو للمشاهدة

Class: Insecta

Subclass: Pterygota

Division: Exopterygota

3.3.4. Order: Ephemeroptera
(Epherous= living a day: pteron=wing)

May fly
ذبابة مايو

Fig (22): May fly

A-Habitats Habitats:

— Mayflies, in general, are aquatic insects. The immature stage lives in fresh and **brackish** water for more a year, however, the adults are outdoor stage, relatively, for a short time. Approximately, appear in may every year Mature Stage: Adults Live in outdoor. They live for a short time (3 days) Immature stages: Aquatic Subimagoes or Nymphs. They live for one year or more

Fig (23): An Ephemeropteran adult

An Ephemeropteran subimago

B- Morphology

I- Adults:

A- Head:

a- Mouthparts: Atrophied. Biting m.p.. b- Antennae: *fine

***Setacious or *Filiform, C- Eyes: large compound eyes, 3 Ocelli**

B- Thorax:

a- Legs: unfitted: 1 segmented tarsus, b- wings: memberanous, 2 piars

C- Abdomen:

10 seg, abdomen, Cerci: one pair, Caudal filament, but it absent in Hexagenia

C-Taxonomy

Class: Insecta

Subclass: Pterygota

Order: Ehemeroptera

1- Family: Ephemeridae, e.g. *Ephemera* sp. and e.g. *Hexagenia* sp.

D- Biology

Live Cycle

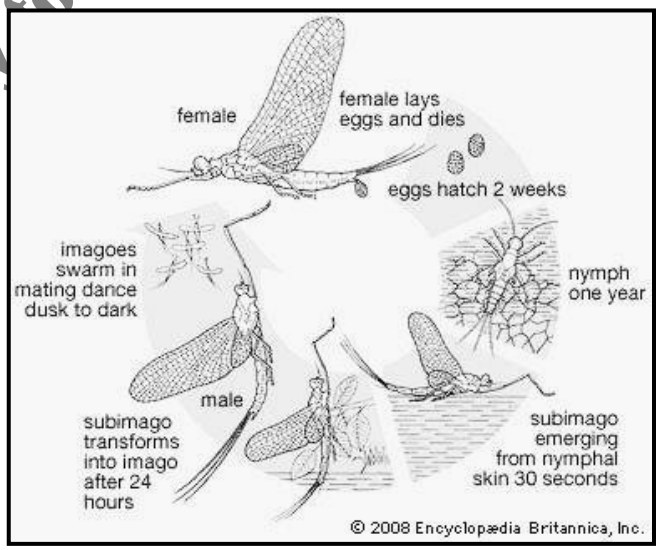


Fig (24): Ephemeropteran life cycle

E-Video Epemeropteran life cycle:

https://www.youtube.com/watch?v=PBHBfck67D8 فيديو للمشاهدة

3.3.5. Order: Odonata

اليعسوبيات

(Odontus=teeth)

A-Habits and Habitats :

Odonata is an order of carnivorous insects
Adults prey on mosquitoes adults as well as the nymphs attack larvae of the mosquitoes.
Therefore, they are biological control agents
The immature stage live in fresh water
However, the adults age outdoor stage form.
Dragonfly nymphs live in ponds or marshy areas because the waters are calmer than in a stream or river.

Sometimes they can be found in the calmer backwaters of rivers, too.

Dragonfly nymphs may eat smaller dragonfly nymphs as they develop.

B- Size:

Small to large from 18 mm to 192 mm

C- Morphology

Fig (25): A dragonfly…….. A damesfly

—

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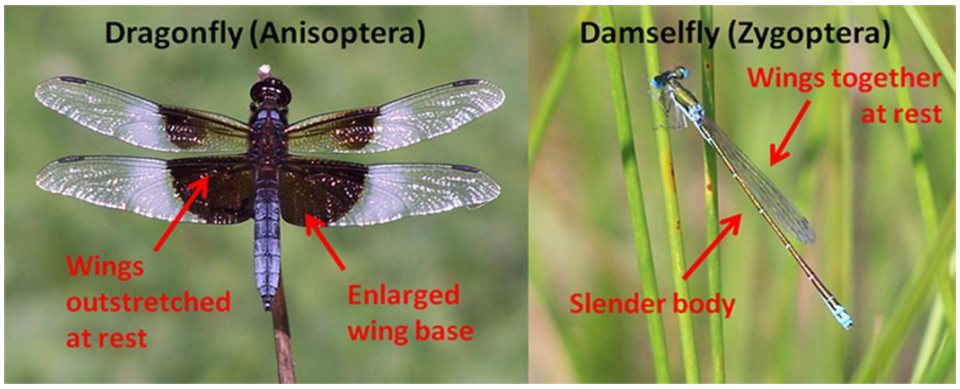


Fig (26): Comparison (1) between Anisopteran and Zygopteran individuals

A-Head:

— **1-hypognathous+Large+globular+movable, 2- <u>Mouthparts</u>: Chewing or mandibulate, Prehensile in nymph, 3- <u>Antennae</u>: fine, setaceous or filiform and 4- <u>Eyes</u>: touched or separated large or small compound eyes and 3 ocelli.**

B-Thorax:

— **Prothorax----Small, Mesothorax ------ Large, #Wings: 2 pairs or different or similar memberanous wings, Pterostigmata--- a thick cell or unit on the wing, *Pterostigmata serve to reduce the self-excited vibration at critical emergency accident speed and *Nodus**

— **Legs: Unfitted, 3 seg. Tarsi,**

C-Abdomen:

— **10 seg. +vestigial 11th, Cerci--- 2 claspers for, Copulation**

D-Taxonomy

— **Class: Inseta**

— **Subclass: Pterygota**

— **Division: Exopterygota**

— **Order: Odonata**

Table (1): Comparison between the Dragonflies and Damselflies or Anisoptera vs. Zygoptera

— Suborder: Anisoptera	— Suborder: Zygoptera
— Family: Lebillulidae	— Family: Agrionidae
— *Crocothemes erythrea*	— *Ischnura senegalensis*
— *الرعاش الكبير*	— *الرعاش الصغير*

—

—

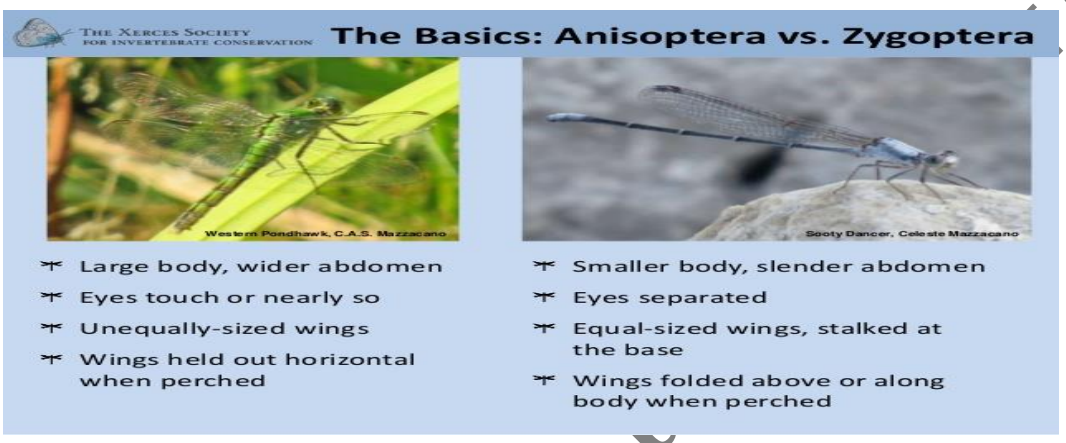


Fig (27): Comparison (2) between Anisopteran and Zygopteran individuals

E-Life Cycle

The Dragonfly Life Cycle

— There are three stages of the dragonfly life cycle, the egg, the nymph, and the adult dragonfly.

— Life cycle can take up to four years to complete.

—

—

—

—

—

—

Fig (28): Odonatan Males and females Copulation

A male and a female dragonfly will mate while they are flying in the air.
After two dragonflies mate, the female dragonfly will lay her eggs on a plant in the water, or if she can't find a suitable plant she will just drop them into the water.

Nymph

Once the dragonfly eggs hatch, the life cycle of a dragonfly larva begins as a nymph.
Dragonfly nymphs live in the water while they grow and develop into dragonflies.

Adults

- Metamorphosis into a dragonfly by crawling out of the water up the stem of a plant. The nymph will shed its skin (exuvia) onto the stem of the plant and will then be a young dragonfly. سوف تتخلص الحورية من جلدها على جذع النبات ، ثم تكون اليعسوب الصغير. Once the dragonfly leaves the exuvia it is a full grown dragonfly. The dragonfly will hunt for food and begin to look for a mate. Once the dragonfly finds a mate, the female will find a body of calm water that will be a good place to lay her eggs.
- The life cycle begins all over again. Adult dragonflies only live about two months.

F-Video on odonatan life cycle

https://www.youtube.com/watch?v=sziM4FGIIUs **فيديو للمشاهدة**

Class: Insecta

Subclass: Pterygota

Division: Exopterygota

3.3.6. **Order: Orthoptera**

مستقيمة الأجنحة

Locusts+Grasshoppers+Crickets

الجراد +النطاطات+صراصير الغيط و المنزلية

Order: Orthoptera

Order: Orthoptera is large order includes:

Grasshoppers, or true locusts, Katydids and crickets

A-Habits and Habitats:

B-Size: Median to large: Live on Land, Herbivores - low on food chain, Swarms - agricultural pests such as the locusts and Living in houses and farms like crickets

C-Morphology

A- Adults:

1-Head:

*** Mouthparts: for biting**, ***Eyes: Large Compound eyes**, **absent or present Ocelli**. ***Antennae: multiarticulate+filiform or Setacious**

2- Thorax:

Prothorax: Large with shield-like tergum. **Mesothorax: Narrow**, **Metathorax: Large**. **Legs:** for walking, 1-4 seg. Tasi. **Wings:** for wings: cornified, straight venation, hind wings: membranous

Abdomen: Segments: 8-9 seg., 3 reduced terminal abd. Seg, and short Cerci

E- Table (2): Comparison between Cealifera and Ensifera

Comparison	**Cealifera** الجراد	**Ensifera** النطاطات و الصراصير
Habitats	Diurnal activity	Noctornal
Head: Eyes auditory	Large sharp compound eyes Strong hearing	Weak c.e weak
Legs	Longe	short

Antennae	Short	Longe
Auditory organ أعضاء السمع	On the tergum of the abd. seg	On the tibia of the fore legs
Stridulatory organs أعضاء الصوت	On the vertical lateral parts of the fore wings **على الأجزاء الجانبية الرأسية للأجنحة الأمامية**	By vibration of **عن** horizontal parts of the for wings **طريق اهتزاز الأجزاء الأفقية للأجنحة**

Include most of the major groups of singing insects, taxa in which males stridulate to call mates and stridulation involves rubbing together modified portions of the forewings in katydids (or bush-crickets (Tettigoniidae).

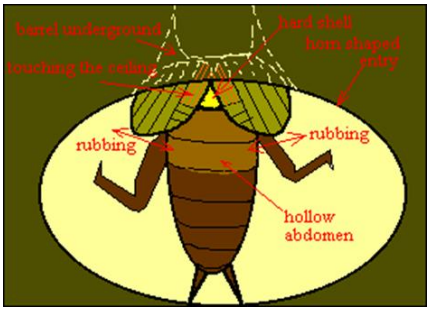
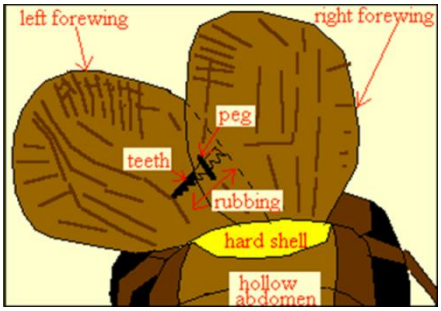


Fig (29): Stridulation in Ensifera and **Cealifera**

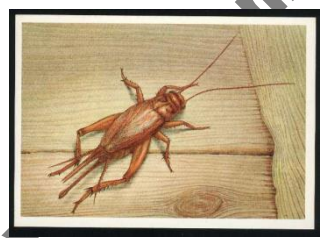


C-Taxonomy

Suborder : Family: Acrididae: Locusts

Fig (30): ***Tryxalis nosuta***… ***Schistocerca gregaria***

Fig (31): 2-Family: Tittigonidae: ***Grasshoppers*** and ***Phanoroptera roseata***



3-Family: Gryllidae:

Gryllus domesticus ***Gryllus bimaculatus***

الصرصور المنزلى الأليف ***الصرصور ذو البقعتين***

Fig (32): 4- Family: Gryllotapidae: ***Gryllotalpa africana***

With stocky shovel-like for leg

الأرجل الأمامية ممتلئة تشبه المغرفة

D- Biology

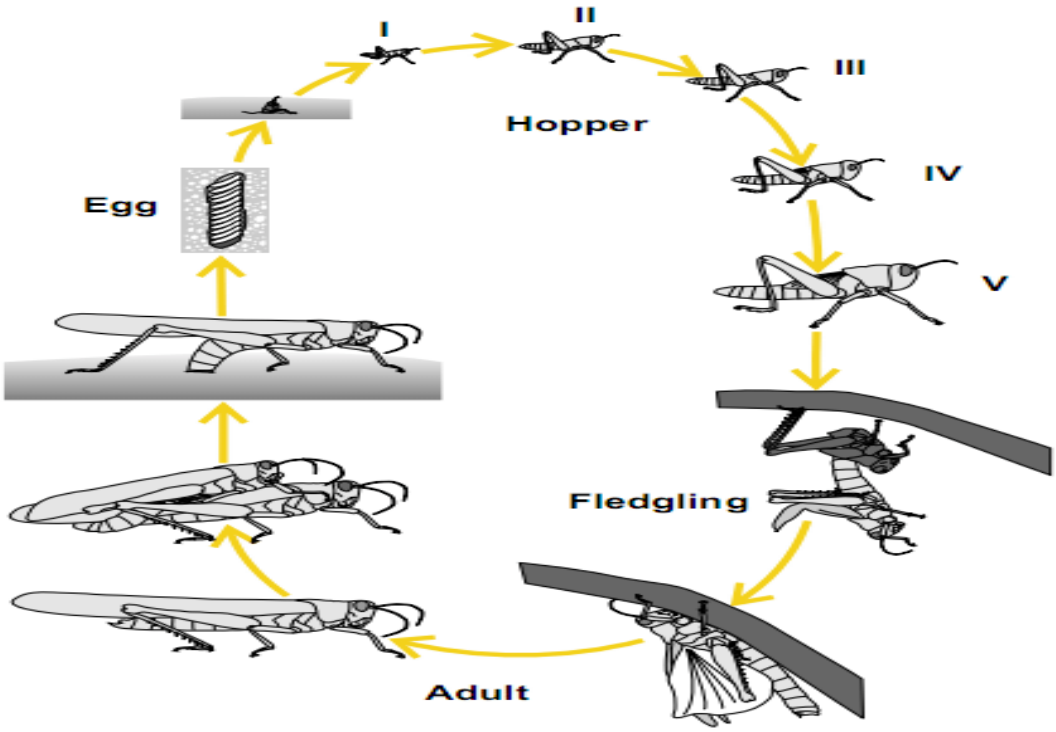


Fig (33): Life cycle of a tittigonid insect

E-Video on life Cycle of the odonatous insects **فيديو للمشاهدة**

https://www.youtube.com/watch?v=dhyCPpYal3k

3.3.7. Subclass: Pterygota

Division: Exopterygota

3.3.7. Order: Dermaptera

Earwigs

(Derma: Skin ; Pteron: wing)

Fig (34): A dermapteran insect

A-Habits and Habitats:

Size: Median

Metamorphosis: Paurometabpla
Living in houses,
desert,
farms

B-Morphology

A- Head:

Prognathous, eyes: median compound eyes and ocelli. Anyenna: Multiarticulate and Filiform. Mouthparts: Biting

B- Thorax:

Segmentation: Prothorax: movable, Large pronotum. Mesothorax: arrow. Metathorax: Large

Wings: fore wings: elytral or absent, Hind wings: memeb
Clear venation or absent

Legs: Walking (ambulatory), 3 seg. tarsi

Abdomen: 8 seg. in the females

10 seg. in the males

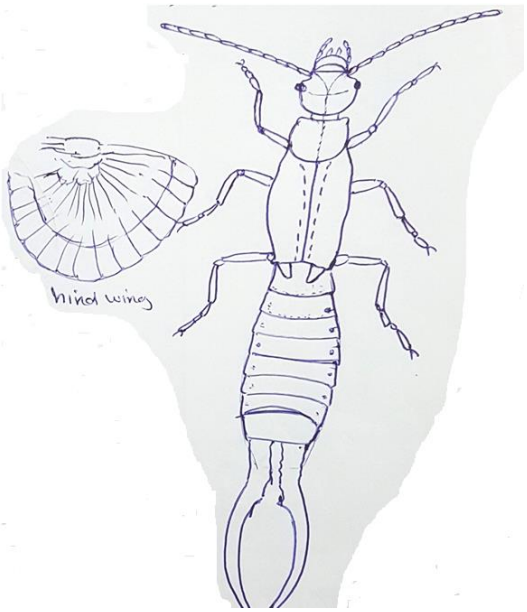


Fig (35): A dermapteran insect

Order: Dermaptera
Earwigs

C. Taxonomy

Class: Insecta

Subclass: Pterygota

Division: Exopterygota

Order: Dermaptera

Family: Labiduridae

Labidura riparia

Class: Insecta

Subclass: Pterygota

Division: Exopterygota

3.3.8. **Order: Phthiraptera or**

Siphunculata (The Lice)

(Siphunculus= a little tube)

رتبة القمل الماص

A-Habits and Habitats:

Ectoparasite insects. They parasite on the Mammalia as human. monkeys, rabbits, cats and rats with small size.

B- Morphology

1- Head:

#Mouthparts: *highly modified for sucking and piercing, retractable when not in use, Eyes: very small or reduced or absent and Antenna: 3-5 segmented small antenna

2- Thorax: Segmentation: fused thoracic segments, dorsal thoracic spiracles
Legs: clinging legs, one segmented tarsi + strong single claws

3- Abdomen: Cerci: absent

C-Metamorphosis: Ametabola

D- Taxonomy

Class: Insecta

Subclass: Pterygota

Division: Exopterygota

Order: Phthiraptera or

Siphunculata

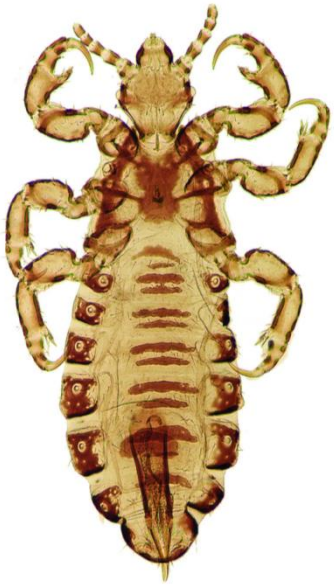
1- Family: Phthiridae

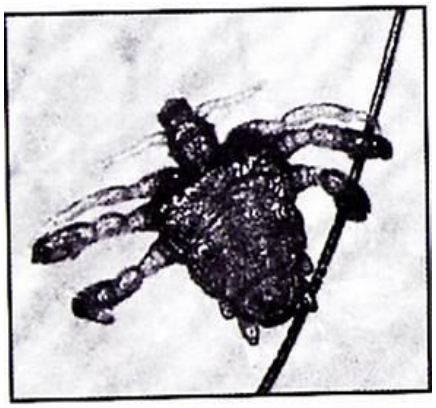
***Pthirus pubis* قمل العانة**

2- Family: Pediculidae

***Pediculus hmanus corporus* قمل جسم الانسان**

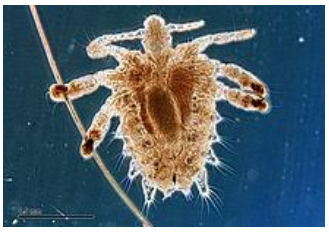
***P. humanus capitus* قمل رأس الانسان**





قمل العانة

Pediculus hmanus قمل الانسان



قمل العانة

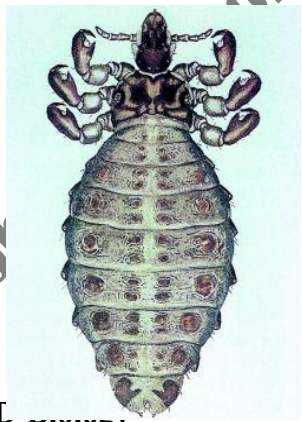


Fig (36): Phthirapteran species

Pthirus pubis

Haematopinus قمل الجاموس

Pediculus humanus:

Cause typhus disease by insect feces, skin scratch or insect body poke destroying

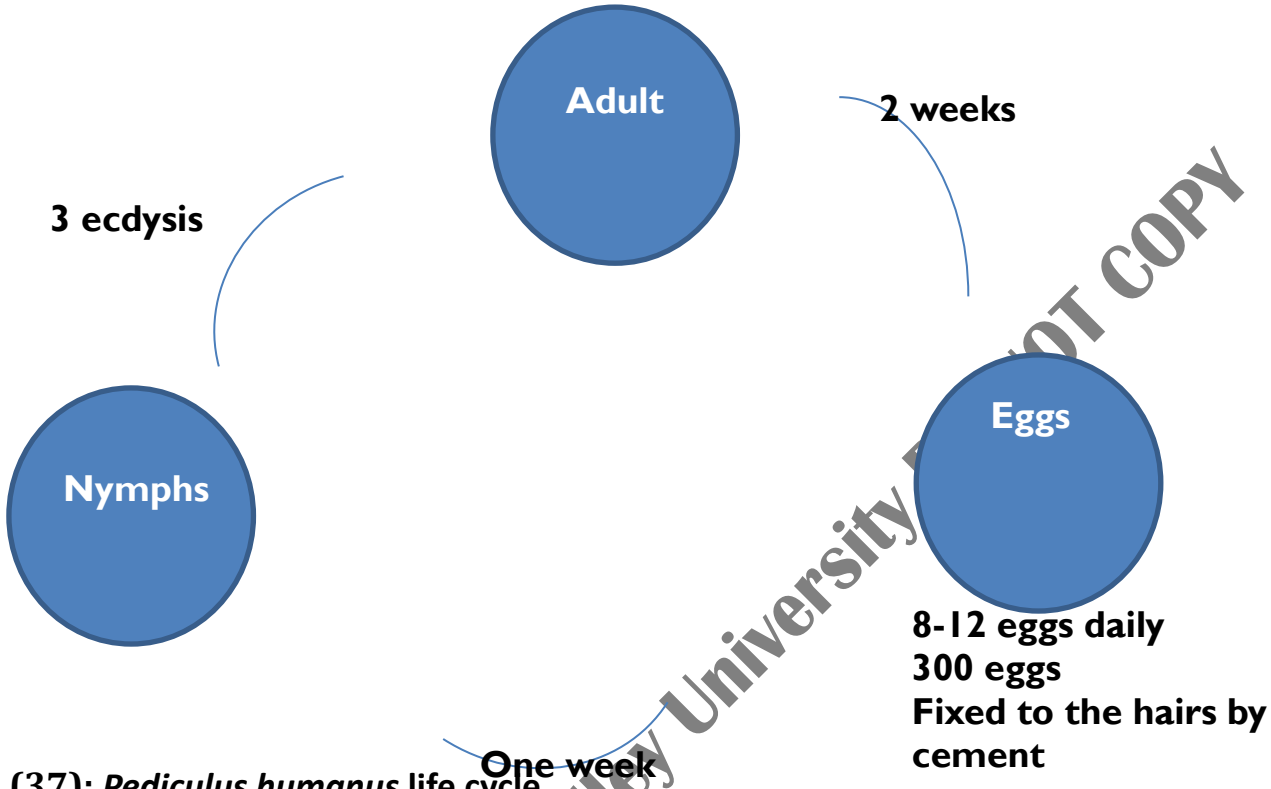


Fig (37): *Pediculus humanus* life cycle

***Pthirus pubis* قمل العانة**

Does not cause diseases

Found on **hair of pubic, sometimes on eyebrow and beard** على شعر العانة و احيانا فى شعر الحاجب او فى اللحية

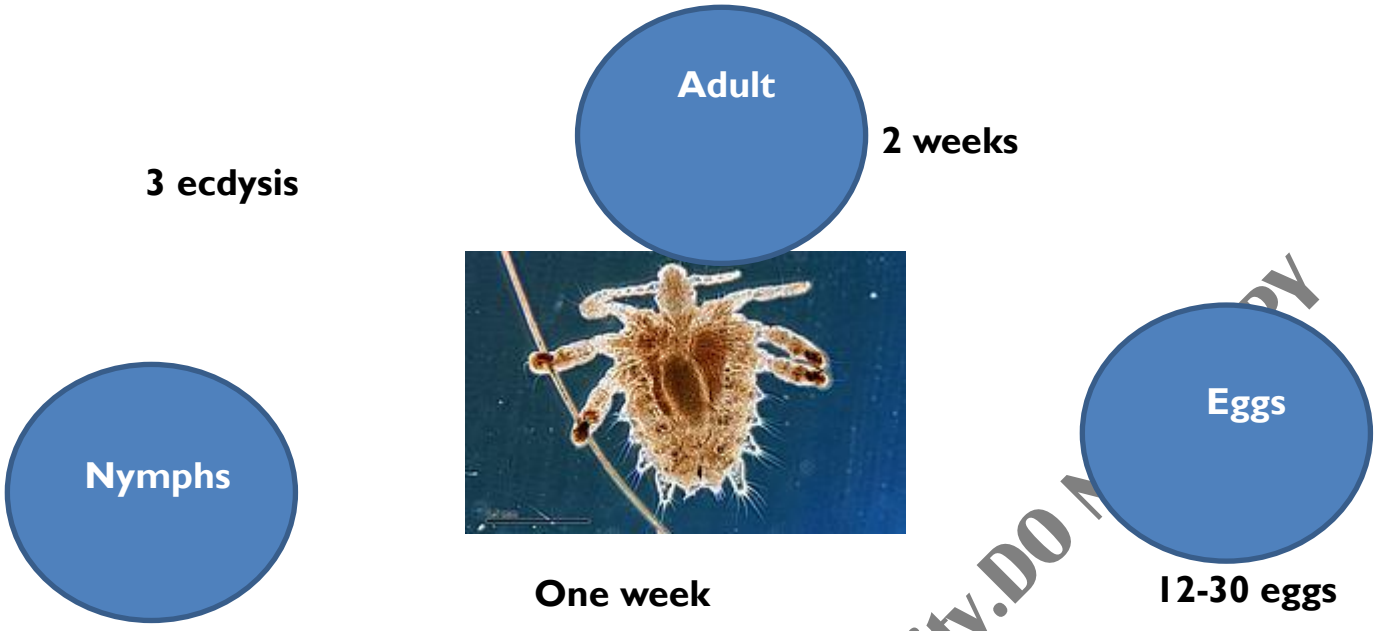


Fig (38): ***Pthirus pubis*** **قمل العانة life cycle**

Class: Insecta

Subclass: Pterygota

Division: Exopterygota

3.3.9. **Order: Isoptera**

Termites or White Ants

رتبة متساوية الأجنحة أو

النمل الأبيض

Fig (39): Workers of the Termites

A-Habits and Habitats:

Social insects living in large or small colonies

Polymorphic

Size: small to moderate

Body: weakly sclerotised & pale in colour

B- Morphology

1- Head:

#Mouthparts: hypognathois or prognathous

*** for biting (mandibulate)**

#Antenna: 10-32 segmented moniliform antennae

2- Thorax: wings: two pairs of elongated similar wings

Or apterour

Legs:*4 segmented tarsi

3- Abdomen: 10 similar segments +reduced 11th

Cerci: 1-8 short segmened cerci

4- Metamorphosis: Ametabola or paurometabola

C-Termite Colony:

Asexual Forms — Sexual Forms

Sterile Castes — Reproductive Castes

Soldiers & Workers — According wings

- Macropterous
- Brchypterous
- Apterous

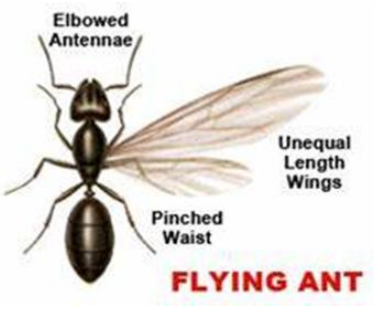
According Size

Queen

Soldier

Queen

Worker



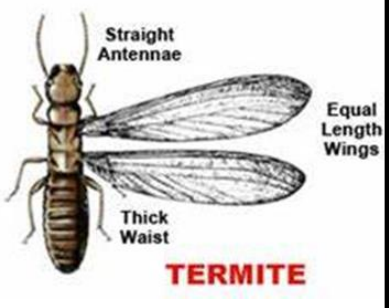


Fig (40): Macropterous Forms and the other colony forms

D-Biology and Ecology of Termite Colony:

1. The colony includes more than one queen and king
2. Queen and king live in nuptial chambers (the royal Chamber)
3. The queen is fertilized occasionally

4. The proper queen and numerous number of individuals migrate leaving the proper colony during a rainy situations
5. The worker make some holes on the nuptial chambers
6. They release and migrate across the chamber holes
7. During flight Several individuals fill down either unable to fly or preyed by some animals such as Birds and Lizards
8. The remain individuals make landing
9. The alate individuals lose their wings
10. Mating (Fertilization) process between males and females
11. The individuals build a new domicile via preforming tunnels called nuptial chambers
12. They lay few number of eggs individuals inside them
13. The eggs hatch to get workers
14. Nymph workers feed on special food
15. Workers care the new eggs
16. The new generation has no reproductive individuals
17. The queen grows or develop gradually
18. The workers serve the queen
19. The queen feed on special food which is different from that of workers
20. Queen live about 6-9- years
21. Queen lay approximately 4000 eggs every time
22. The queen develops from the reproductive individuals when alate reproductive be absent.

Class: Insecta

Subclass: Pterygota

Division: Exopterygota

3.3.10. Order: Hemiptera

رتبة نصفية الاجنحة

(Hemi=Half; Pteron=Wing)

A-Habits and Habitats:

A-Size: minute to large

B- Morphology

Head:

Mouthparts: Piercing and sucking mouthparts. They piercing plant and animal tissues and extract the sap and blood, respectively. Eyes: comp. ----large. Ocelli: present or absent. Antennae: filiform or pilose, short or longe and at least 10 seg.

Thorax:

Segmentation: prothorax-----large. Mesothorax--------covered by large quadrate scutellum. Metathorax: -----narrow or small

Wings: fore wing: larger than hind wings, carenareous at least in the base region

More carenareous (Homoptera) or less in Heteroptera and Hind wings: memberanous, Reduced venation

Legs: walking legs

For legs may be modified for seizing preys. Tarsi: 3 or less segments

Abdomen:

1st or 1st +2nd abdomenal seg. Are reduced or absent. The last+ the terminated seg. Are fused and reduced. Cerci: always absent

Metamorphoses: mostly paurometabola, rarely complete

C- Taxonomy

A-Suborder: Heteroptera

Family: Pentatomidae— ***Nezara viridula***

Family: Cimicidae ***Cimex lectularis***

Family: Belotomatidae: ***Lethcerus niloticus***

F:Notonectidae: ***Notonecta glauca***

Corixidae: ***Corixa* sp.**

Fig (41): Different heteropteran families and species

D- Table (3): Comparison between suborder: Homoptera and Heteroptera

	Heteroptera	Homoptera
Head	Prognathous	Hypognathous or deflesed
	Antenna: 4-5 seg	2-10 seg.
Thorax	Large	Small
tarsi	3 seg.	3 or more
feeding	Omnivores	Phytophagous
Wings	Heterogenous	Homogenous
	Less carenaceous	more carenceous

B-Suborder: Homoptera

Family: Jassidae **Aphididae (Plant Lice)**

Empaosca labica ***Aphid gossypi***

جاسيد القطن **من القصب او البطيخ**

Fig (42): nymphs of *Aphid gossypi*

— The color of the insect is green or black. The insect (nymphs) absorbs the Plant sap. Since the sap contains high carbohydrate and low

proteins, and in order for the nymph to obtain the needed amount of protein for its growth, it absorbs a large amount of Plant sap.

— It is dispose the excess of the carbohydrate as a honey marterials through pees. When conditions are appropriate, the Aphid proliferate intensively. The Aphid insects for the plants are concentrated on the terminal bud, leaves and small growths, which causes wrinkle and bend its edges to down in addition to the excretory.

—

C-Honeydew Honey

Honeydew Honey on the top surface of the following leaves down
This honeydew honey fills the gaps.
And facilitates the growth of black fungus "Auricularia polytricha " and therefore when the almonds opening, the hair will be polluted , it will reduce its grade and it will difficult to segregate it . in addition to, the availability of the honeydew honey will facilitates the adhesion of the dust on the infected plants, you can easily observe and remotely characterize it by its bright appearance.

Life Cycle

- Its reproduction through asexual from the cotton (Parthenogenesis) in Egypt.
- And does not show males and the female does not lay eggs, but give birth to a young breeds and then from 1 to 6 every day for several days to three weeks.
- Nymphs reach the length of the full insect after five days, and the insect has around 5-65 g / y.

Class: Insecta

— **Subclass: Pterygota**

— **Division: Endopterygota**

3.3.11. **Order: Hymenoptera**

— **Ants, Bees and Wasps**

— **رتبة غشائية الأجنحة**

— **رتبة النمل و النحل و الدبابير**

A-Habits and Habitats:

The Hymenoptera, with over 130,000 named species, are a contender for the second largest order of insects in the world
(the Beetles, Coleoptera boast a the greatest number of species).

Some scientists estimate that there are more than 300,000 species of Hymenoptera in the world, though only 130,000 have been named so far.

Parthenogenesis is more common among the Hymenoptera than any other order of animals, according to Imms. Though in many orders, parthenogenesis is the means of sex determination (i.e., fertilised eggs become one sex and unfertilised eggs the other), there are some hymenopteran species in which males have never been found – and reproduction occurs only as a result of parthenogenisis.

— **Size: minute to large.**

— Polymorphism. Some of them have starvation, generosity and predation الاستعباد و الكرم و الافتراس

— **B- Morphology**

Adults:

— Head:

— Free, movable, mouthparts: for chowing. Antennae: multiarticulate, moniliform or filiform. Eyes: comp. ----large. Ocelli: 3 ocelli

Thorax:

Segmentation:

Mesothorax enlarged and fuced with either pronotum and metathorax

Abdomen:

1st abdomenal seg. Is fused with metathorax to form prppodeum.

Ovipositor: modified into slicing or piercing organ for inserting eggs into tissues or adapted as sting. Larvae: Eruciform اسطوانية, with distinct head capsule, 3 pairs of legs and 6-8 abdominal prolegs أرجل أولية بطنية

C- Taxonomy

Order: Hymenoptera

Family:

Formicidae	**Vespidae**	**Apidae**
Formica sanguina	***Vespa orientaliss***	***Apis mellifica***

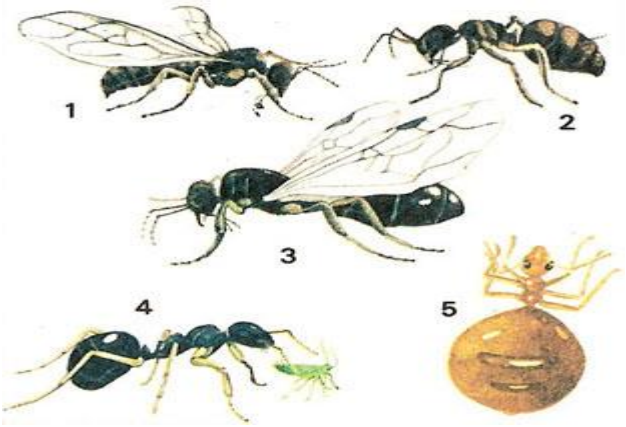
Order: Hymenoptera

Family: Fomicidae

Colony of Formicidae

Fig (43): Hill of ants

Workers, Drones, Soldies and Queeen:



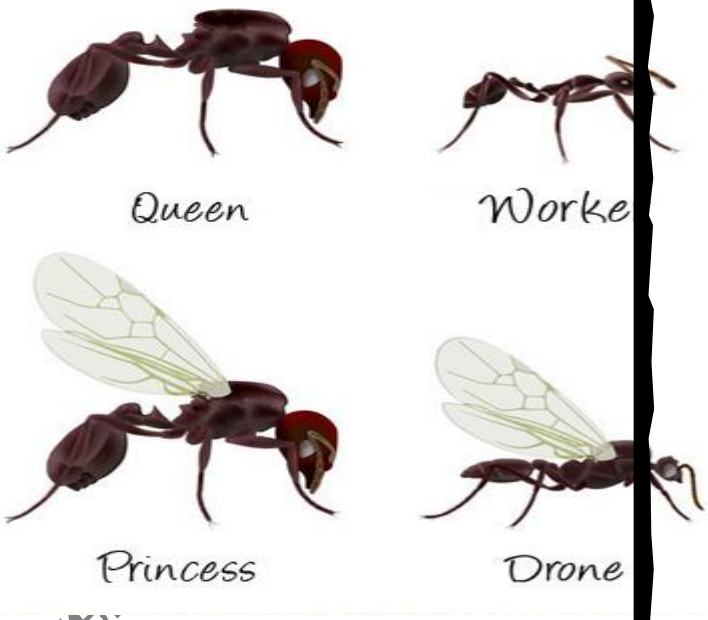


Fig (44): Workers, drones, soldies and queeen

D-Life Cycle of Ants:

Copulation takes places while they fly during the suitable periods يتم التسافد فى الوقت المناسب أثناء الطيران. Where, workers prevent that copulation except for during the suitable time. As will as females and males, Flying, Landing. They lose their wings. Borrow tunnels and chambers. Settle isolated until they lay eggs (perhaps this process takes months). females depends on body fats muscles to feed during isolation. The females lay two types of eggs. Fertilized eggs and none fertilized eggs بيض مخصب و اخر غير مخصب. Thus, the fertilized eggs hatch to produce queens, however, the other produce both workers and drones. Larvae feed on female saliva to develop into pupae to workers. Workers: connect the chambers to each other and to outdoor. collect food and care larvae and pupae and feed these immatures

Order: Hymenoptera

Family: Apidae النحل

The bees Colony:

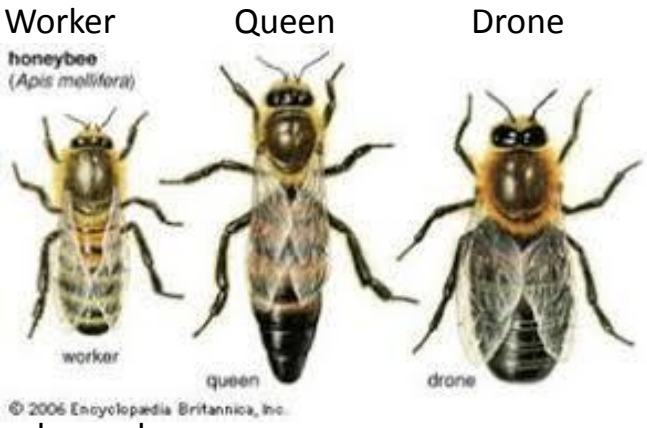


Fig (45): The bee colony:

Habits and Habitats:

Bees live in colonies included Castes of Queen, Drones and workers

Biology of the honey bee colony:

*During the first three days of larvae age, workers feed the larvae on royal jelly secreted by a glands located on the worker head

*After the first three days, workers feed the larvae of drones and workers on mixed of royal jelly, honey and pollens and feeding their on honey and pollens
*After maturation of the larvae, workers cover the hexagon by wax and pollens
*Larvae are transformed into pupae to produce a new queen and colony

The Old Queen:

*The old queen leaves the colony with numerous numbers of drones and workers to settle on a tree for 48 hours. After 48 hours the old colony individuals either go away or someone collect them to establish a new throne of bees (عرش النحل)

The New Queen:

*The new queen kill the old queen if the last be stayed in the same place of the new colony. Workers take the killed old queen out of the colony
*The new queen and its workers destroy the old hexagons containing pupae and larvae to take them out. After two weeks, the queen and drones fly for wedding (Queen flies to high altitudes and copulation occurs)

*Queen kill drone groom by pulling and separating its male genital organs to the colony. Queen lies about 200 to 250, 00 eggs
*Workers make starving to drones and the other larvae to kill them and taking them out.

Class: Insecta

Subclass: Pterygota

Division: Endopterygota

3.3.12. **Order: Diptera**

رتبة الذبابيات

A-Habits and Habitats:

— The Diptera or true flies are an amazing order of insects, which can be readily recognised in their adult forms because those which have wings (and most of them do) have only *two*. Nearly all other flying insects have four wings.In the true flies the hind wings have become modified into a pair of small balancing organs called halteres. The only other insects with two wings are the Strepsiptera.

— Diptera occur all over the world except in regions with permanent ice-cover. They are found in most land biomes including deserts, caves, freshwater and marine water. Insects are the most diverse group of Arctic animals (about 3,300species), of which about 50% are Diptera.

B- Morphology

Adults:

Head:

Movable, **compound eyes** large and **mouthparts** designed for piercing and sucking m.p. or for lapping لاعقة and sucking in the other groups. Antennae: thin, long in suborder Nematocera, short suborder Brachycera.

Thorax:

—Wings: only a single pairThe hindwings (halteres) evolved into advanced mechanosensory ميكانيكية حسية organs, which act as high-speed sensors of rotational movement and allow them to perform

advanced aerobaticsبهلوانات جوية. Legs: Claws and pads on their feet enable them to cling to smooth surfaces.

Abdomen:

— **Segmentation**: eleven-ten. The 10th and 11th segments having fused.
— **Ovipositor**: The last 2 or 3 segments are adapted for reproduction as ovipositor .

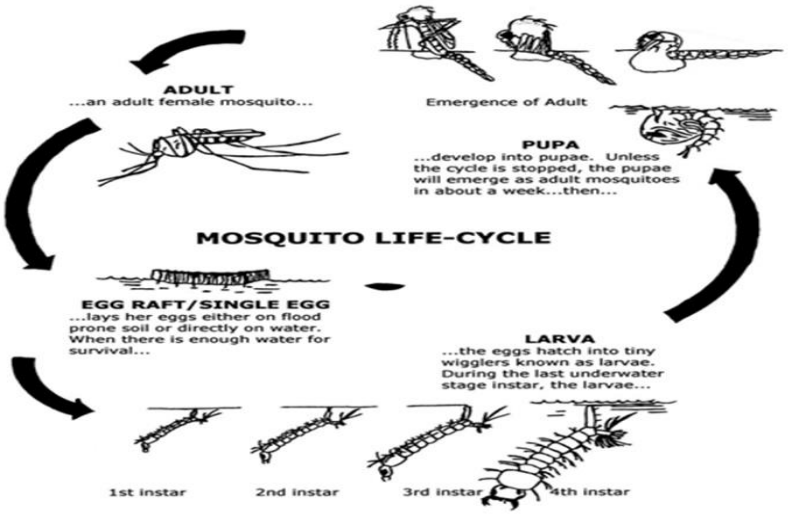
C-Taxonomy

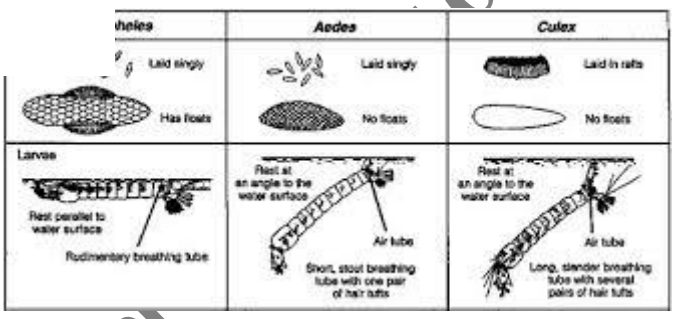
The order Diptera is divided into two suborders Nematocera with about 110 families divided between them; Only about 125,000 species have a species described including the familiar housefly, horsefly, cranefly, and hoverfly

Order: Diptera

Suborder:

Nematocera: Family Culicidae, *Culex pipiens*, *Aedes* sp. and *Anopheles* sp.
Brachycera: Family: Muscidae, *Musca domestica*





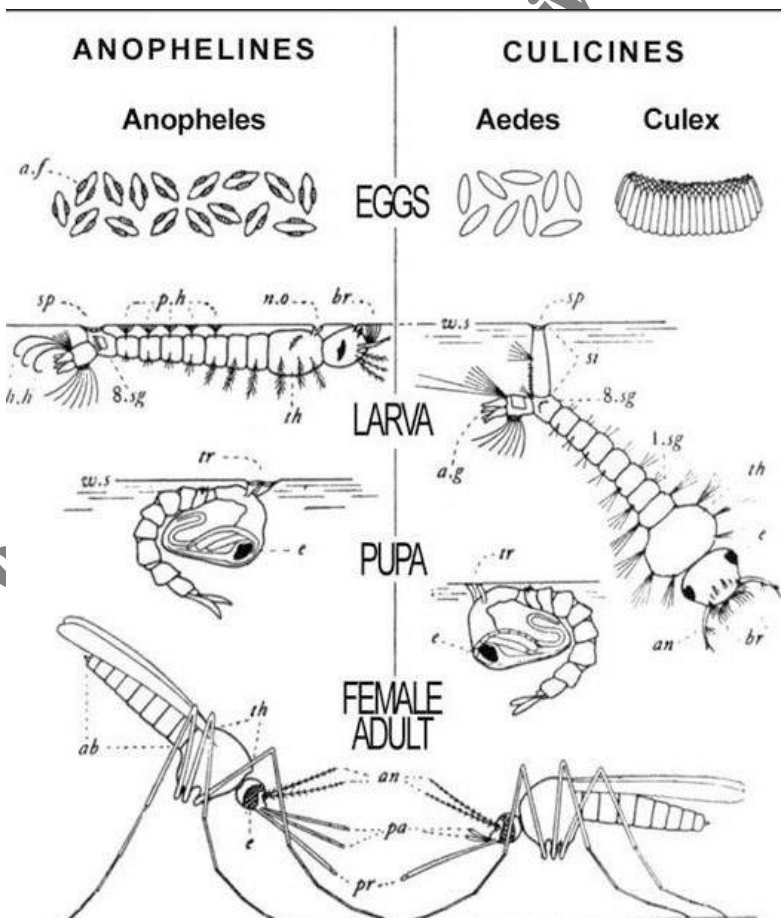
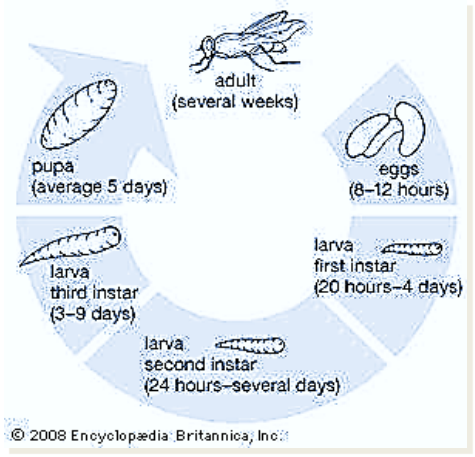


Fig (46): Mosquito life Cycle



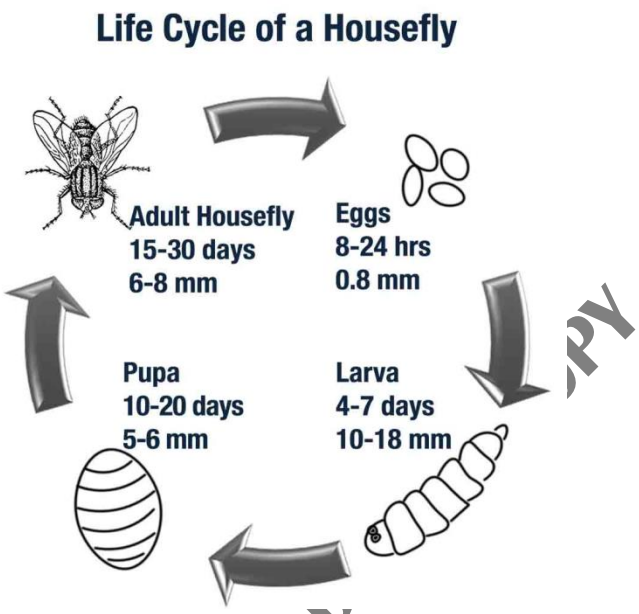


Fig (47): *Musca domestica* life cycle

Class: Insecta

Subclass: Pterygota

Division: Endopterygota

3.3.13. **Order: Coleoptera**

رتبة السوس و الخنافس و الجعران

General Information and size: The Coleoptera, with about 400,000 species,

The largest of all orders, constituting almost 40% of described insects and 25% of all known animal life-forms. The largest of all families, the Curculionidae (weevils) with some 70,000 member species and found in almost every habitat except the sea and the polar regions.

Beetles can be described as holometabolous insects with biting mouth parts and 2 pairs of wings. The first pair of which are modified into leathery elytra, which are not used in flight (though they may act as aerofoils). The Prothorax is large and the Mesothorax much reduced. The larvae are usually campodeiform or eruciform, with biting mouthparts. The pupa are generally adecticous and exarate.

Morphology:

Adults:

— **Head**: Mouthparts:----Chewing. Thorax: Wings Front wings(elytra) are hard and serve as covers for the hind wings; Hind wings large, membranous, folded beneath the elytra. Tarsi 2- to 5-segmented

Immature stages:

— Head well-developed with ocelli and chewing mouthparts.
— Three pairs of thoracic legs; no abdominal prolegs
— Body form:

Campodeiform -- Slender, active crawlers, scarabaeiform -- C-shaped body and elateriform -- Wireworms; longate, cylindrical,

C-Taxonomy

Order: Coleoptera

Family:

Meloidae (blister beetles)

Staphylinidae (rove beetles)

Curculionidae (weevils beetles)

Carabidae (ground beetles)

Scarabaeidae June beetles, scarab beetles

Coccinellidae lady beetles



Meloidae **Staphylinidae** **Curculionidae**



Carabidae **Scarabaeidae** **Coccinellidae**

Fig (48): Coleopteran families

Class: Insecta

Subclass: Pterygota

Division: Endopterygota

3.3.14.**Order: Lepidoptera**

Moths and Butterflies

الفراشات و ابو الدقيق

It is one of the most widespread and widely recognizable insect orders in the world. About 180,000 species of the Lepidoptera are described, in 126 families and 46 superfamilies 10% of the total described species of living organisms. Size: minute to large Having economic significance

The Lepidoptera (Butterflies and Moths) are by far the most popular group of insects, in both the mind of the general public and with Entomologists.

There are more books on Lepidoptera (see butterfly books) and more people collecting and working on Lepidoptera – than any other insect order. Everybody loves Butterflies.

The Lepidoptera are one of the five great orders of insects… and when all the counting has been finished, will probably be fighting for 3rd place with the Diptera, behind the Hymenoptera and the Coleoptera, but ahead of the Hemiptera (especially in those taxonomic organisations that split the Hemiptera into 2 orders).

B- Morphology

Body: covered by scales or hairs as well as the wings

Adults:

Head: hypognathous, eyes: large comp. eyes, ocelli ofintly present. Mouthparts: consisted of elongated galea.

Thorax: prothorax ----small or narrow

Mesothorax---large with strong scutum, metathorax--- reduced

Wings: covered by lage scales, coupling: Frenulate or jugate

Wing venations: mostly longiudinal

Legs:

Walking legs and 5 segmented tarsi

Abdomen: 10 segments

1st reduced seg with atrophied sterna, 9+10th abdominal segments are modified to serve in external genital parts

Larvae: Cylindrical

Pupa: Exarate or obtic

Holometabola

C-Taxonomy

Order: Lepidoptera

Comparison between suborder: Rhopalocera and Heterocera

Suborder: Rhopalocera	**Heterocera**
Butterflies	**Moths**
Antenna: Clavate	**pectinate or bipectinate**
Pupae: no cocoon	**with cocoon**
Colors: shine	**No shine colours**

Suborder: Rhopalocera Heterocera

Family: 1-Pieridae Noctuidae

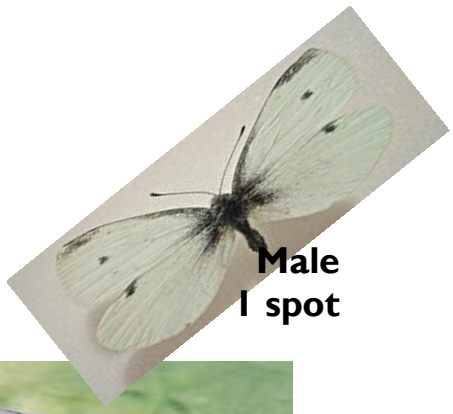
Pieris rapae 1-*Prodenia litura*

أبى الدقيق الكرنب

دودة ورق القطن

Pieris rapae *Sesamia cretica*

Fig (49): Life Cycle of *Prodenuia litura*



Male
1 spot

Female
2 spots

eggs

1-Prodenia litura

Pupa
تتعلق بواسطة خسط حريرى

Fig (50): ***Prodenia litura***

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2.Quistions for training

Write the name of insect orders having holometabola

Write the name of insect orders having Hemimetabola

Write the name of insect orders having paurometabola

Write the name of insect orders having ametabola

Compare between orders you studied according their habitats

Compare between orders you studied according their legs

Compare between orders you studied according their mouthparts

Compare between orders you studied according their wings

Compare between orders you studied according their antennae

Compare between orders you studied according their abdominal segments

Compare between orders you studied according their taxonomy

Compare between orders you studied according their expected economical importance

Compare between orders you studied according their abdominal appendages

Compare between orders you studied according their biological stories of one of each.

PRACTICAL STUDY ON INSECT TAXONOMY

Class: Insecta

Subclass: Apterygota

Order: Thysanura or

Zygentoma

(*thysanos*=fringe; *uara*= tail)

Silver Fish

السمك الفضى

Family: Lepismatidae

(exempli gratia in Latin),e.g.

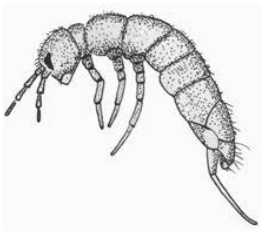
Lepisma saccharina

It lives (under bark)

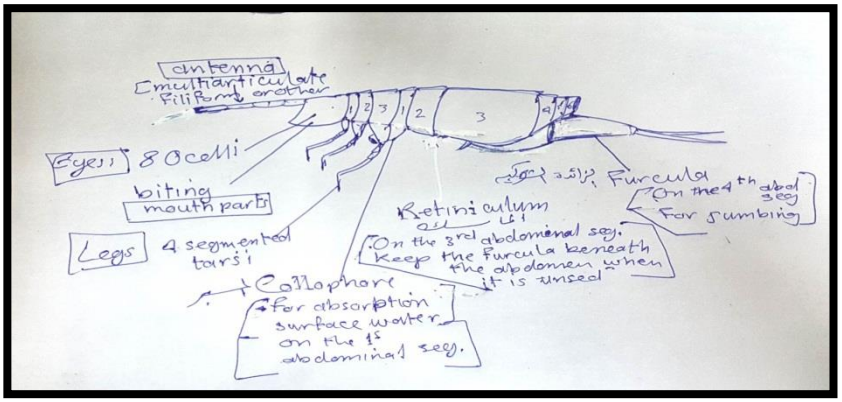
Order: Collembola

Springtails

قافزة الذنب



Family: Sminthuridae e.g *Sminthurus* sp.



— **Class: Inseta**

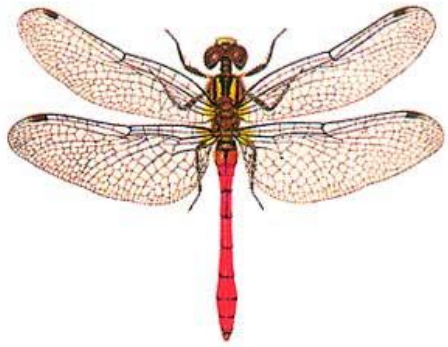
— **Subclass: Pterygota**

— **Division: Exopterygota**

— **Order: Odonata**

— **Suborder: Anisoptera…… Zygoptera**

— **Dragonfly…… Damesfly**



— **Family: Lebillulidae**	— **Family: Agrionidae**
— ***Crocothemes erythrea***	— ***Ischnura senegalensis***

Class: Insecta

Subclass: Pterygota

Division: Exopterygota

Order: Orthoptera

مستقيمة الأجنحة

Locusts+Grasshoppers+Crickets

الجراد +النطاطات+صراصير الغيط و المنزلية

Suborder: Cealifera الجراد

Locusts

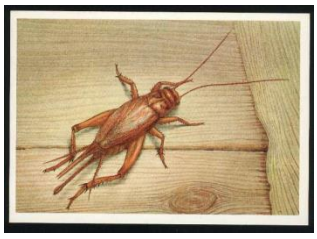
1- Family: Acrididae: *Tryxalis nosuta*

Schistocerca gregaria

1- Family: Acrididae: *Truxalis nosuta*

Locusta migatoria

2-Family: Tittigonidae: *Grasshoppers*, *Phanoroptera roseate*



3-Family: Gryllidae: *Gryllus domesticus* ***Gryllus bimaculatus***

4- Family: Gryllotapidae: *Gryllotalpa africana*

Class: Insecta

Subclass: Pterygota

Division: Exopterygota

Order: Dermaptera

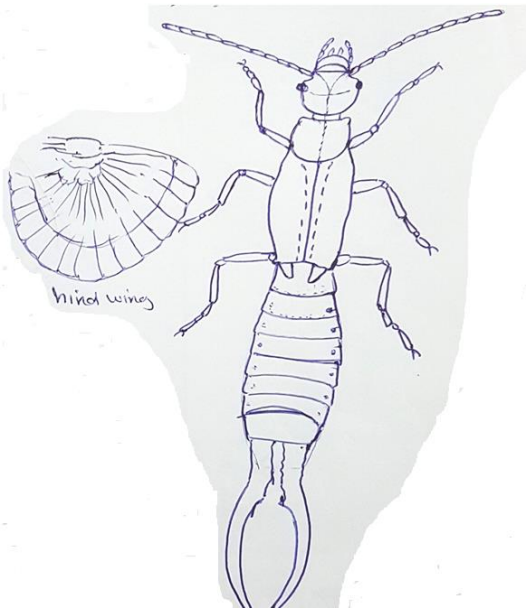
Family: Labiduridae

Labidura riparia

Earwigs

(Derma: Skin ; Pteron: wing)

Labidura riparia



Class: Insecta

Subclass: Pterygota

Division: Exopterygota

Order: Phthiraptera or Siphunculata (The Lice)

(Siphunculus= a little tube)

رتبة القمل الماص

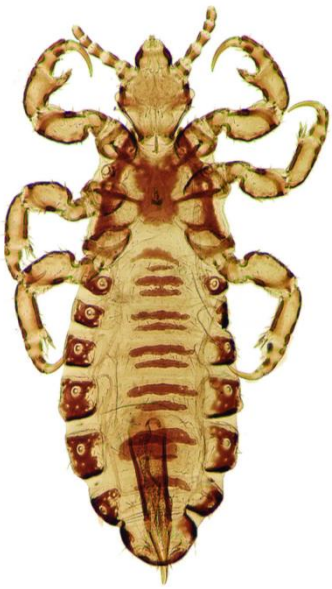
1- Family: Phthiridae

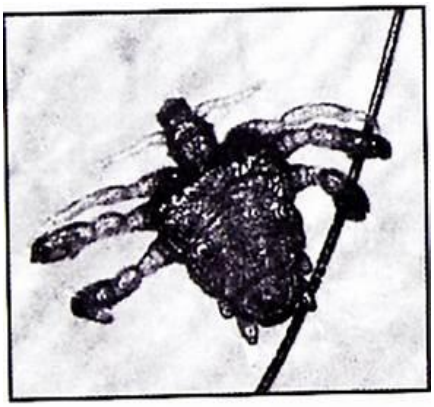
***Pthirus pubis* قمل العانة**

2- Family: Pediculidae

***Pediculus hmanus corporus* قمل جسم الانسان**

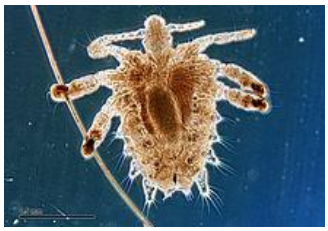
P. *humanus capitus* *قمل رأس الانسان*





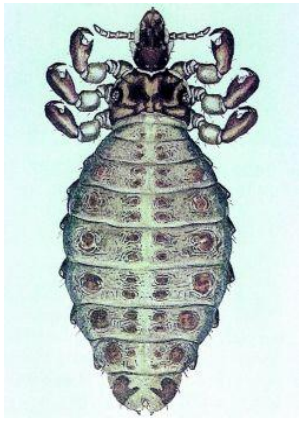
قمل العانة

Pediculus hmanus **قمل الانسان**



قمل العانة

Pthirus pubis



Haematopinus **قمل الجاموس**

Class: Insecta

Subclass: Pterygota

Division: Exopterygota

Order: Isoptera

Termites or White Ants

رتبة متساوية الأجنحة أو النمل الأبيض

Family: Rhinotermitidae

Psammotermes hypostoma

Worker of Psammotermes hypostoma

Class: Insecta

Subclass: Pterygota

Division: Exopterygota

Order: Hemiptera

رتبة نصفية الاجنحة

(Hemi=Half; Pteron=Wing)

Suborder: Heteroptera

Family: Pentatomidae— ***Nezara viridula***

Family: Cimicidae ***Cimex lectularis***

Family: Belotomatidae: ***Lethcerus niloticus***

F:Notonectidae: ***Notonecta glauca***

Corixidae: ***Corixa* sp.**

Different heteropteran families and species

OrderL Blattodea

Family: Blattidae

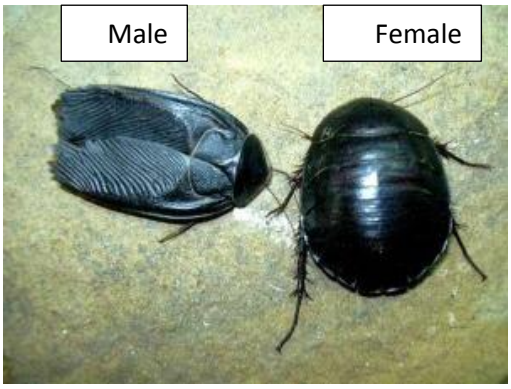
e.g. Periplaeta americana

Blatetella germanica

OrderL Blattodea

Family: Polyphagidae

Polyphaga eagyptiaca

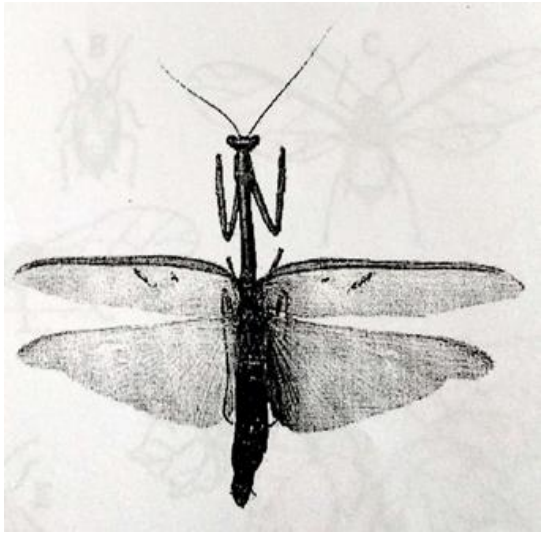


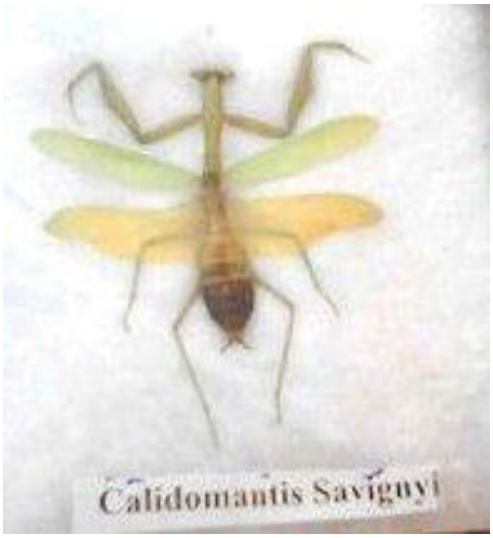
Order: Matodae

Family: Mantidae

Sphadromantis bimaculata

Colidomantis savignyi ***فرس النبى الصغير***





Mantis religiosa ***فرس النبى الكبير***

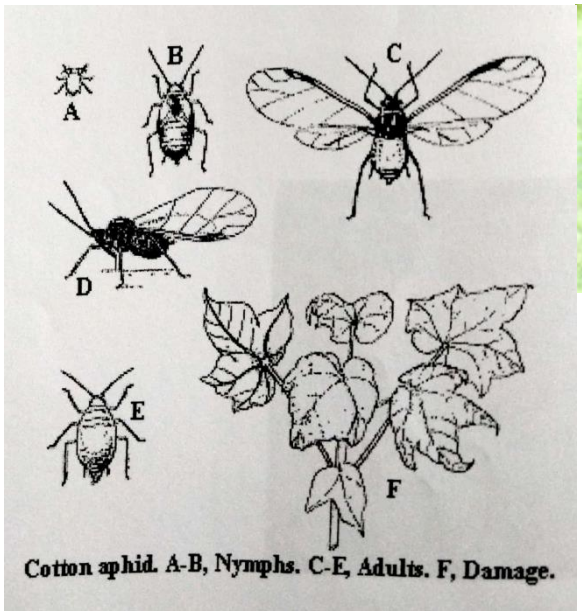
Order: Hemiptera

Suborder: Homoptera

Family: Aphididae

Aphis gossypii

من القطن



Cotton aphid. A-B, Nymphs. C-E, Adults. F, Damage.

Order: Hemiptera

Suborder: Homoptera

Family: Monophlebidae

Icerya eagyptiaca

البق الدقيقى المصرى

Suborder: Homoptera

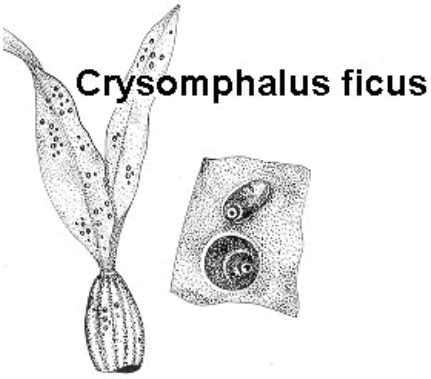
Family: Monophlebidae

Icerya purchasi

Suborder: Homoptera

Family: Diaspididae

Chrysomphalus ficus



Class: Insecta

Subclass: Ptrygota

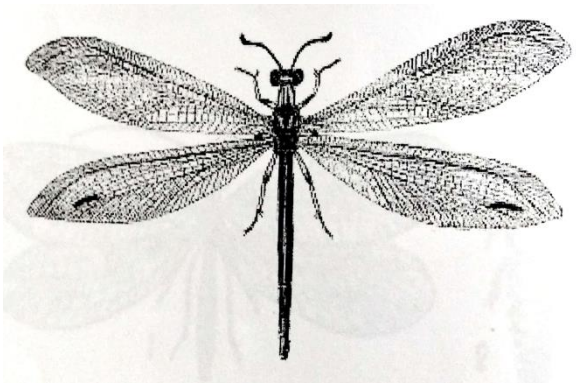
Division: Endoptrygota

Order: Neuroptera

Family: Myrmeleontidae

Creoleon africanus

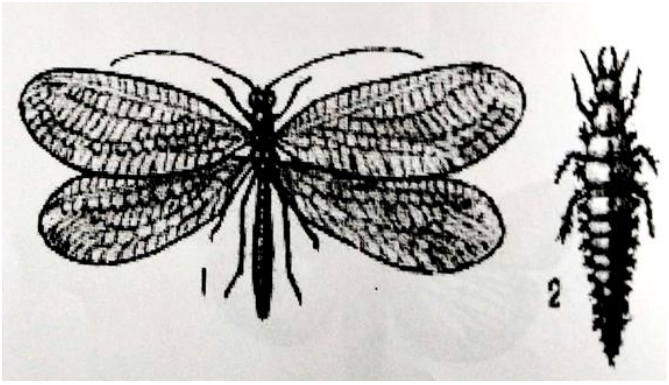
أسد النمل



Family: Chrysopidae

Chrysopa volgaris

أسد المن



Class: Insecta

Subclass: Ptrygota

Division: Endoptrygota

Order: Lepidoptera

Suborder: Heterocera

Family: Noctuidae

Agrotis ipsilon

الدودة القارضة

Suborder: Heterocera

Family: Noctuidae

Sesamia cretica

دودة القصب الكبرى

Suborder: Heterocera

Family: Noctuidae

Eirias insulana

دودة اللوز الشوكية

Suborder: Heterocera

Family: Geometridae

Phytometra gamma

الدودة نصف القياسية ذات الحرفY

Suborder: Heterocera

Family: Geometridae

Phytometra ni

الدودة نصف القياسية ذات البقعتين

Suborder: Heterocera

Family: Geometridae

Spodoptera littoralis

دودة ورق القطن

Suborder: Heterocera

Family: Pieridae

Pieris rapae

ابو دقيق الكرنب

Suborder: Heteroc

Family: Bobycidae

Bombyx mori

Class Insecta

Subclass: Pterygota

Division: Endopterygota

Order: Diptera

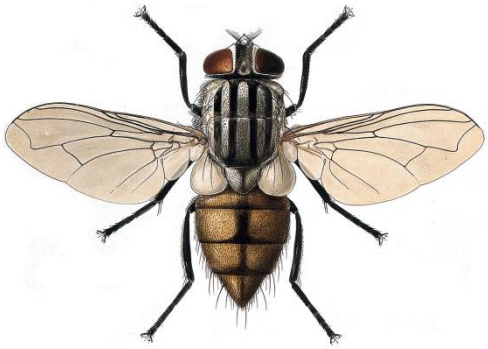
Suborder: Brachycera

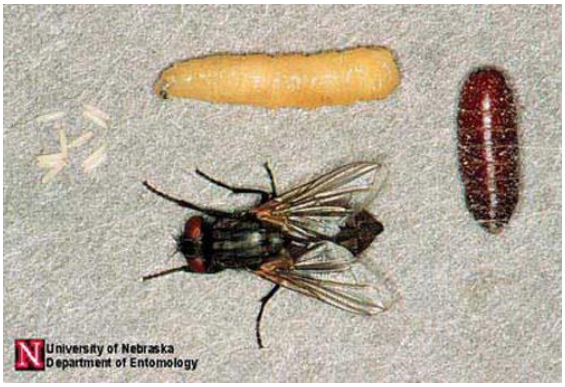
Division: Cyclorhapha

Family: Muscidae

Musca domestica

الذبابة المنزلية





Class Insecta

Subclass: Pterygota

Division: Endopterygota

Order: Diptera

Suborder: Brachycera

Division: Cyclorhapha

Family: Sarcophagidae

Sarcophagi carnaria

ذبابة اللحم

Class Insecta

Subclass: Pterygota

Division: Endopterygota

Order: Diptera

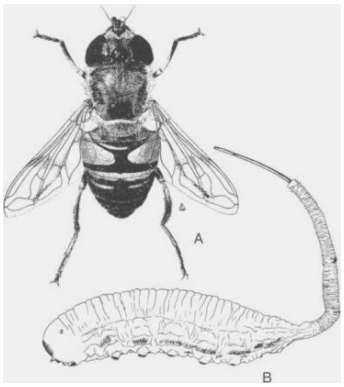
Suborder: Brachycera

Division: Orthorrapha

Family: Syrphidae

***Syrphus* sp.**

ذبابة السيرفس



Class Insecta

Subclass: Pterygota

Division: Endopterygota

Order: Coleoptera

Suborder: Adephaga

Family: Dytiscidae

Cybister tripunctatus africanus

Class Insecta

Subclass: Pterygota

Division: Endopterygota

Order: Coleoptera

Suborder: Adephaga

Family: Carabidae

Calosoma chlorostictum

خنفساء الكالوسوما

Class Insecta

Subclass: Pterygota

Division: Endopterygota

Order: Coleoptera

Suborder: Polyphaga

Family: Coccinillidae

Coccinella undecimpunctata

ابو العيد ذو ال 11 نقطة

Class Insecta

Subclass: Pterygota

Division: Endopterygota

Order: Coleoptera

Suborder: Polyphaga

Family: Staphylinidae

Paederus alferi

Class Insecta

Subclass: Pterygota

Division: Endopterygota

Order: Hymenoptera

Suborder: Apocrita

Family: Vespidae

Eumenus maxillosa

دبور الطين البانى

Class Insecta

Subclass: Pterygota

Division: Endopterygota

Order: Hymenoptera

Suborder: Apocrita

Family: Vespidae

Vespa orientalis

دبور البلح

Class Insecta

Subclass: Pterygota

Division: Endopterygota

Order: Hymenoptera

Suborder: Apocrita

Family: Apidae

Apis mellifera

نحل العسل

Class Insecta

Subclass: Pterygota

Division: Endopterygota

Order: Hymenoptera

Suborder: Apocrita

Family: Apidae

Xylocopa aestuans

نحل الخشب

Class Insecta

Subclass: Pterygota

Division: Endopterygota

Order: Siphonaptera

Family: Pulicidae

Pulex irritans

برغوث الانس

Protozoan parasites

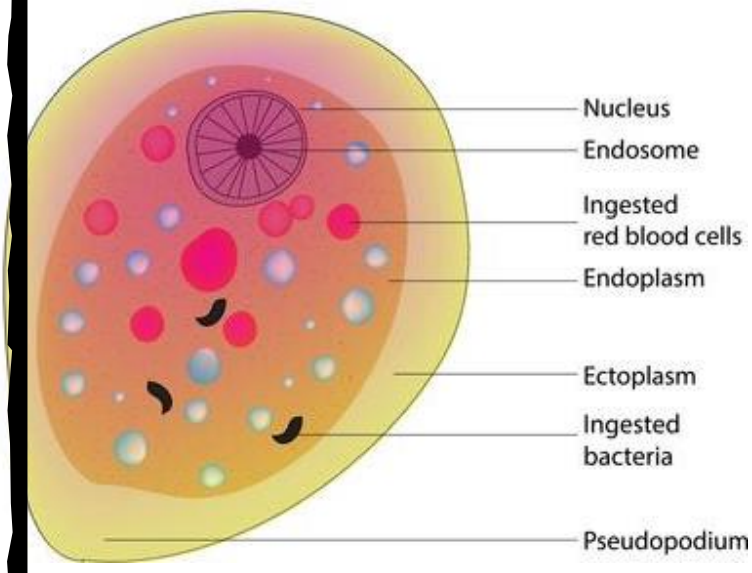
Entameoba histolytica

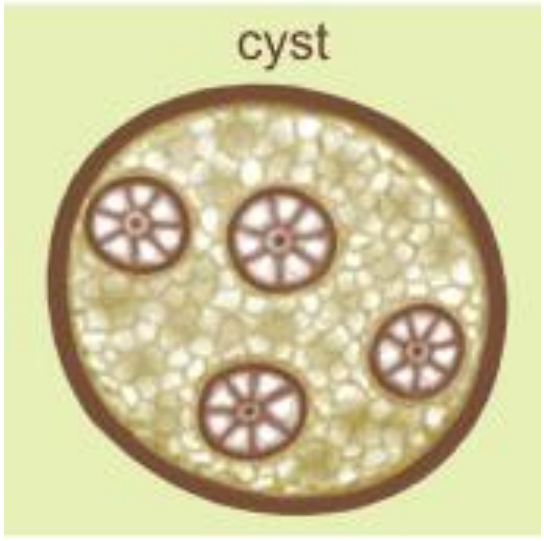
Kingdom : Animalia

Phylum : Protozoa

Class : Sarcodina

e.g. : Entameoba histolytica





Habitat: large intestine

Host : definitive host (man) Intermediate host (none)

Infective stage : mature cyst (contain 4 –nuclei)

Flagellated protozoan parasites

Types of flagellates according to normal habitat
1- intestinal species

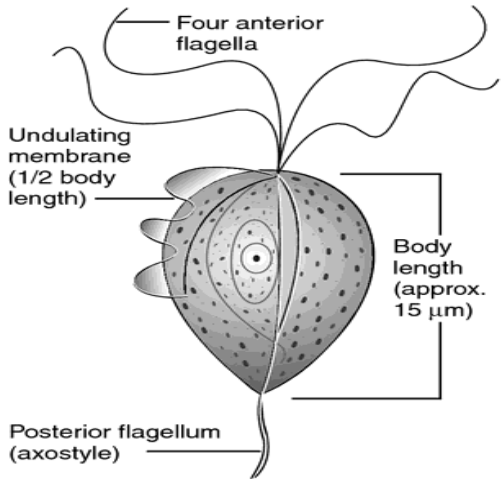
Trichomonas hominis

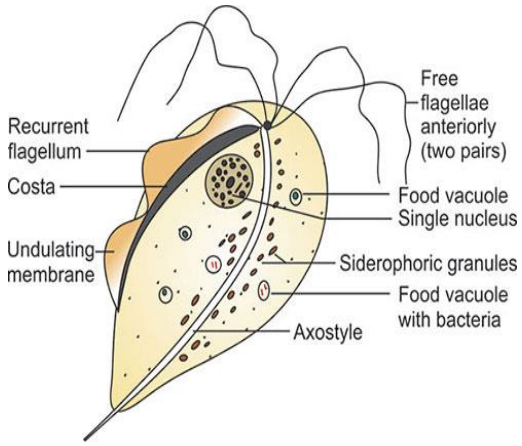
Kingdom : Animalia

Phylum : Protozoa

Class : Mastigophora

e.g. : Trichomonas hominis





Habitat: large intestine especially caecum of human

Host : definitive host (man) Intermediate host (none)

Infective stage : Trophozoite

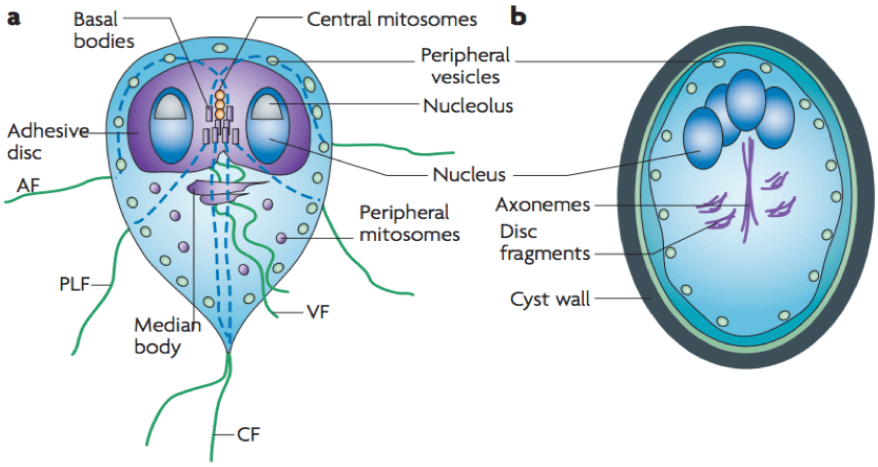
Giardia lamblia

Kingdom : Animalia

Phylum : Protozoa

Class : Zoomastigophora

e.g. : **Giardia lamblia Kofoid**



Habitat: Trophozoite: in the upper part of the small intestine, especially in the children. Also in faesec after laxative and diarrhea.

Host : definitive host (human). Intermediate host (none)

Infective stage : the infected form (cyst)

2- blood and tissue species

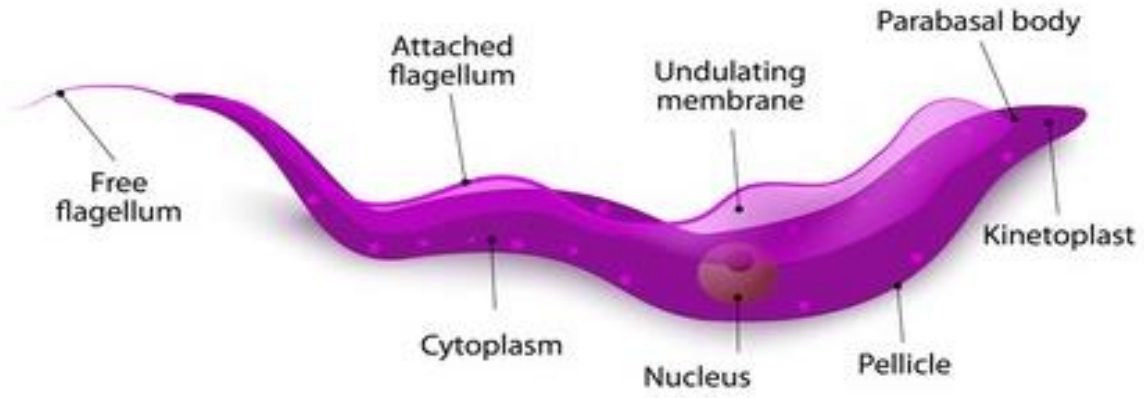
Trypanosoma sp.

Kingdom : Animalia

Phylum : Protozoa

Class : Mastigophora

e.g. : Trypanosoma sp.



Habitat: blood stream

Host : definitive host (human)

intermediate host (Tse – Tse fly)

recevoir host (pigs)

Infective stage : metacyclic stage

3- urogenital species

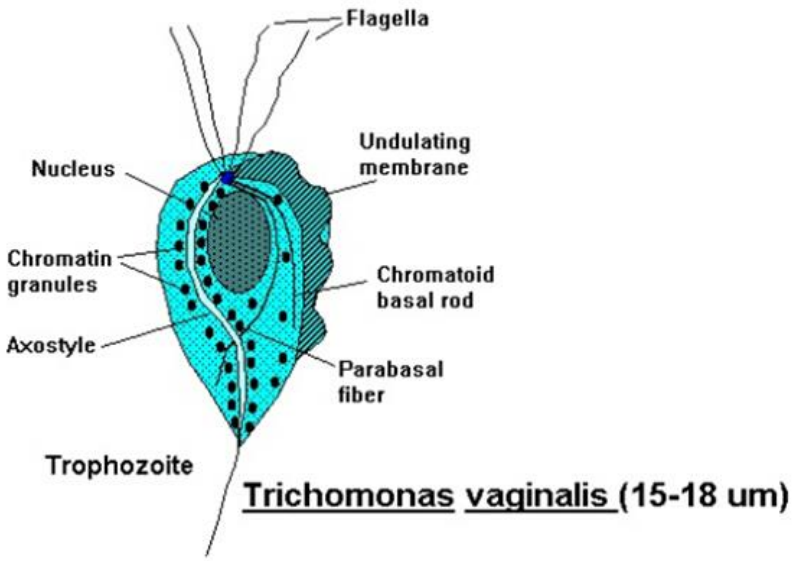
Trichomonas vaginalis

Kingdom : Animalia

Phylum : Protozoa

Class : Mastigophora

e.g. : Trichomonas vaginalis



habitat : in the genital tract of women and man (prostate)
hosts : definitive host (human) intermediate host (none)
infective stage : trophozoite

Ciliated protozoan parasites

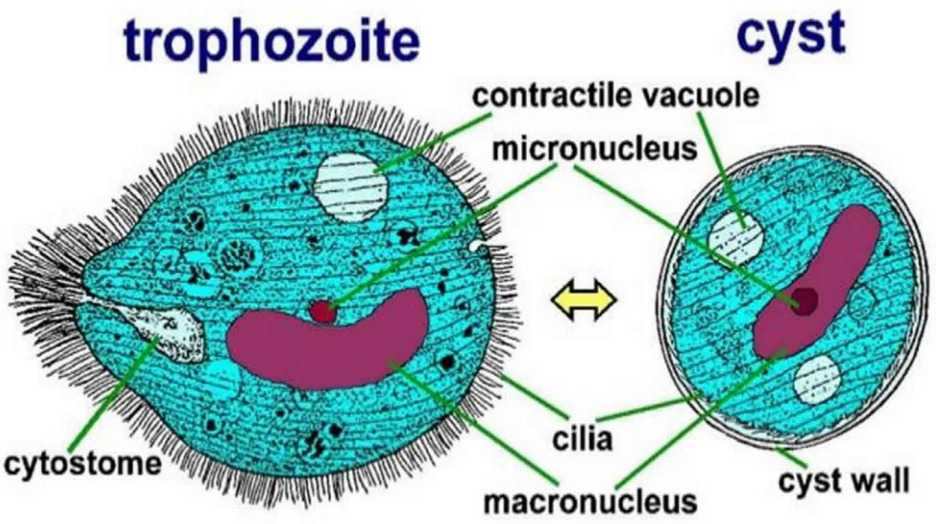
Balantidum coli

Kingdom : Animalia

Phylum : Protozoa

Class : cliophora

e.g. : Balantidum coli



Habitat: large intestine

Host : definitive host (human)

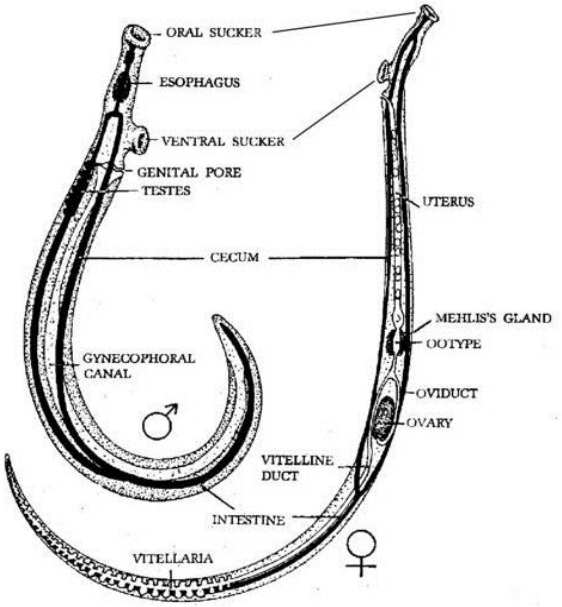
Intermediate host (none) Receiver host (pigs)

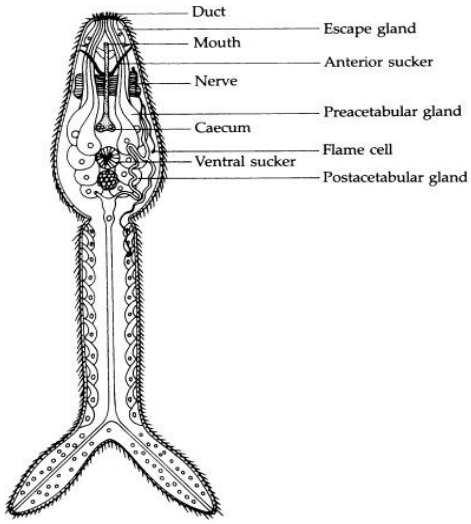
Infective stage : cyst

platyhelminthes Helminthes

Schistosoma haematobium

Kingdom : Animalia
Subkingdom : Eumetazoa
Phylum : Platyhelminthes
Class : Trematoda
Subclass :Digenea
Family : Schistosomatidae
e.g. : Schistosoma haematobium





Habitat: adults (Hepatic portal veins).

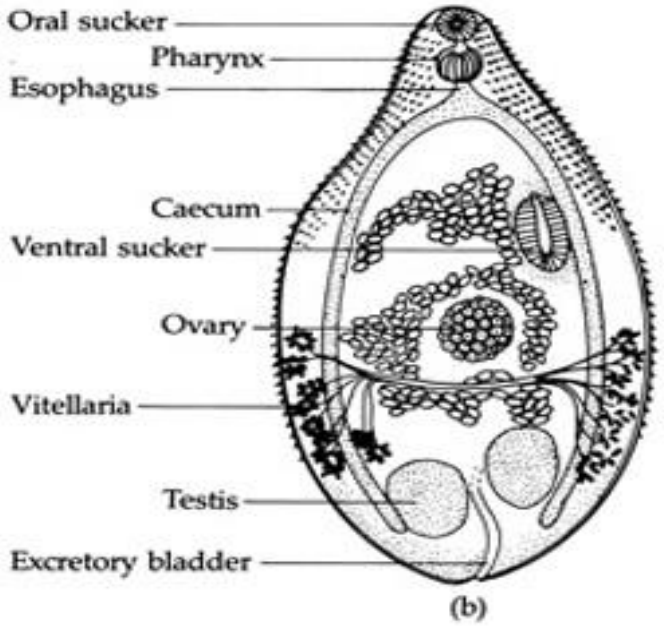
oviposition (venules of urinary bladder).

Hosts : definitive host (man). intermediate host (Bulinus truncatus) reservoir host (monkeys).

Infective stage : furcocercous cercariae

Heterophyes heterophyes

Kingdom : Animalia
Subkingdom : Eumetazoa
Phylum : Platyhelminthes
Class : Trematoda
Subclass :Digenea
Family :Heterophyidae
e.g. : Heterophyes heterophyes



Habitat: small intestine .

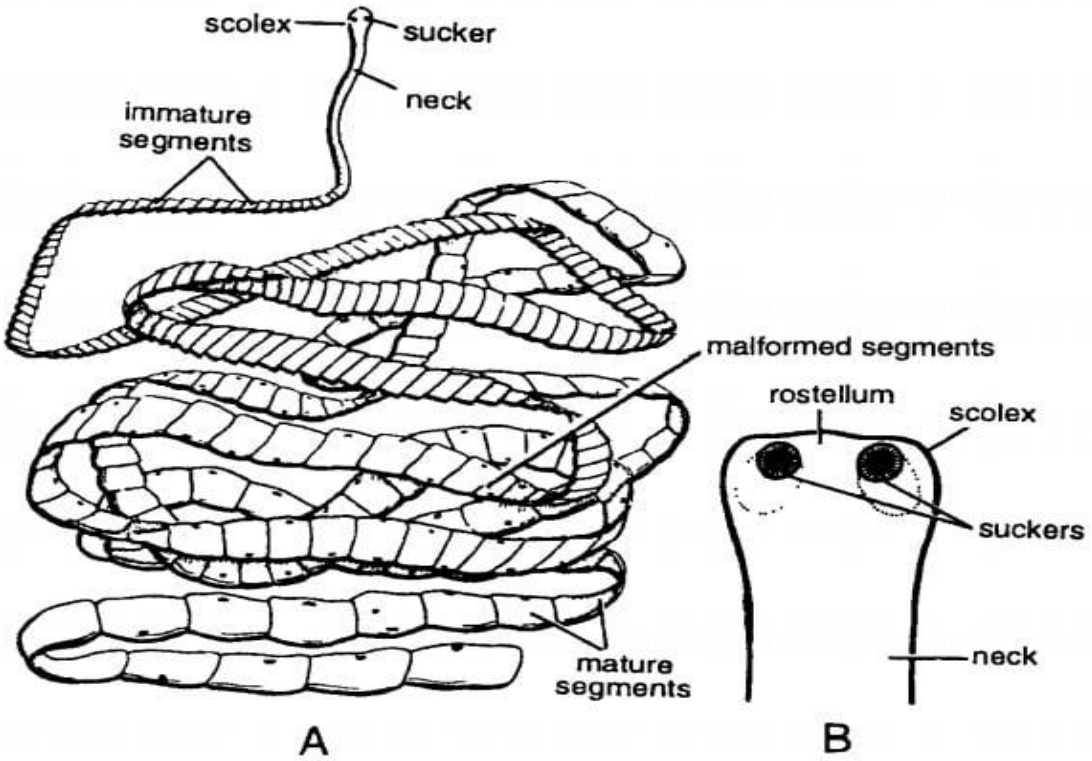
Hosts : definitive host (man) .

intermediate host : snail (first intermediate host) Pironella conica and (second intermediate host) is fish from freshwater or brackish water containing metacercariae (encysted stage).

Infective stage : metacercariae

Taenia saginata

Kingdom : Animalia
Subkingdom : Eumetazoa
Phylum : Platyhelminthes
Class : Cestada
Order :C yclophyllidae
Family : Taenidae
e.g. : Taenia saginata



Taenia saginata. **A.** Entire, **B.** Scolex with neck greatly enlarged.

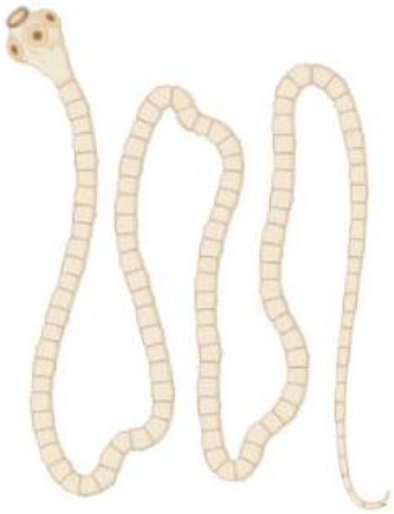
Habitat: small intestine

Hosts : definitive host (man) intermediate host (cows)

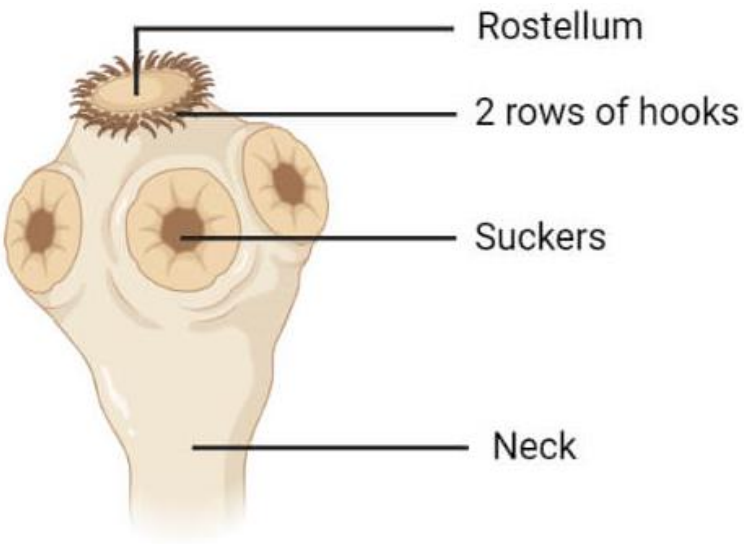
Infective stage : bladder worm

Taenia solium

Kingdom : Animalia
Subkingdom : Eumetazoa
Phylum : Platyhelminthes
Class : Cestada
Order :C yclophyllidae
Family : Taenidae
e.g. : Taenia solium



Adult *Taenia solium*



Scolex

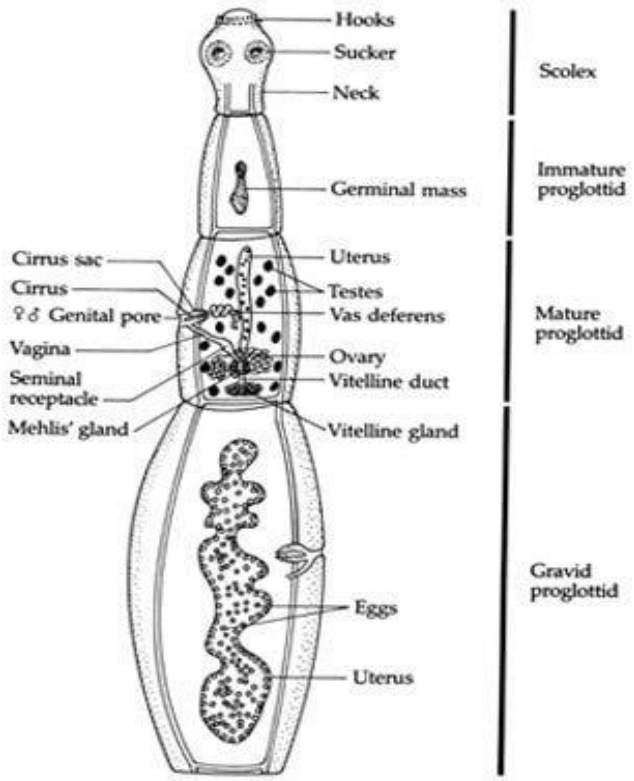
habitat : small intestine

Hosts : definitive host (man) intermediate host (pigs)

Infective stage : bladder worm

Echinococcus granulosus

Kingdom : Animalia
Subkingdom : Eumetazoa
Phylum : Platyhelminthes
Class : Cestada
Order :C yclophyllidae
Family : Taenidae
e.g. : Echinococcus granulosus



Habitat : small intestine

Hosts : definitive host (dogs and foxs)

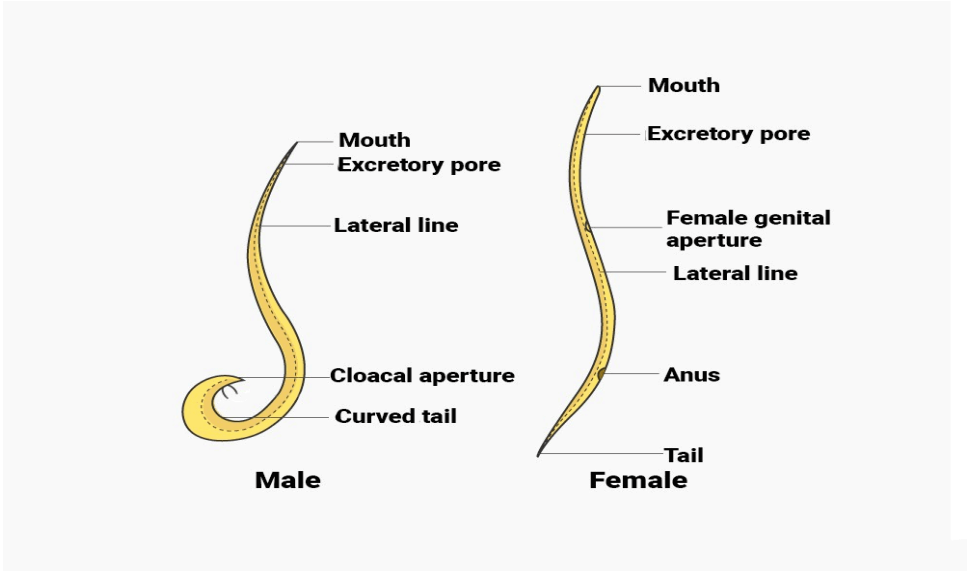
intermediate host (pigs and maybe man)

infective stage : hydatid cyst

Aschelminthes

Ascaris vitulorum

Kingdom : Animalia
Subkingdom : Eumetazoa
Phylum : Aschelminthes
Class : Nematoda
Order : Ascaridata
Family : Ascaridae
e.g. : Ascaris vitulorum



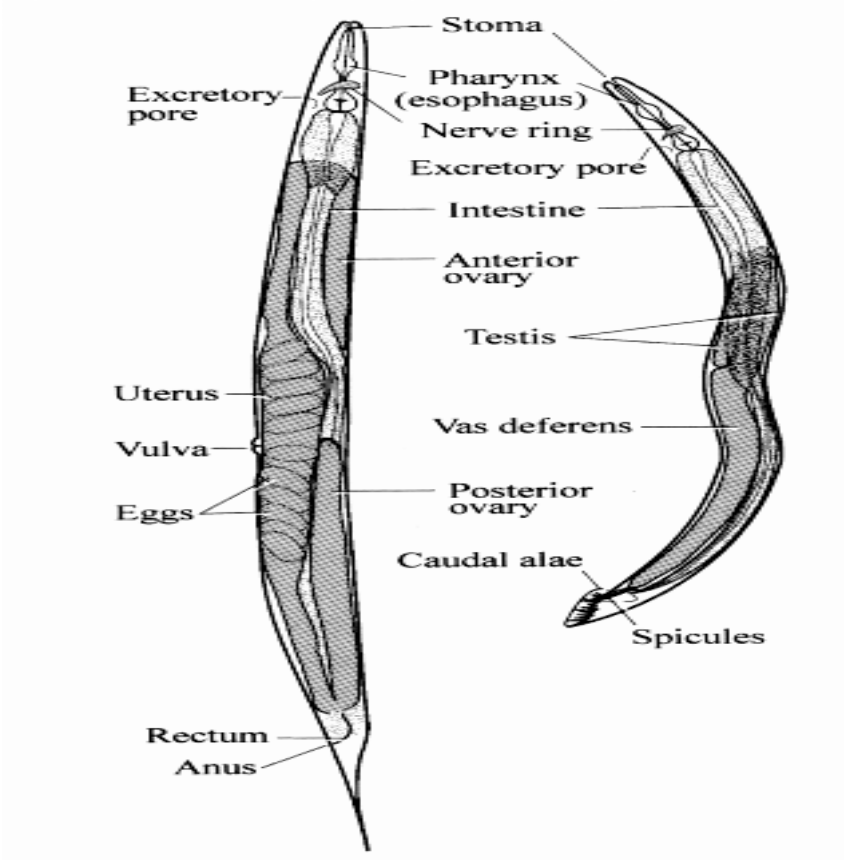
habitat : small intestine

hosts : definitive host (cows) intermediate host (none)

infective stage : embryonate egg

Enterobius Vermicularis

Kingdom : Animalia
Subkingdom : Eumetazoa
Phylum : Aschelminthes
Class : Nematoda
Order : Oxyurata
Family : Oxyuridae
e.g. : Enterobius Vermicularis



Habitat : large intestine , specially colon and appendix

Hosts : definitive host (man) intermediate host (none)

Infective stage : embryonate egg

Ancylostoma duodenale

Kingdom : Animalia
Subkingdom : Eumetazoa
Phylum : Aschelminthes
Class : Nematoda
Order : Strongylata
Family : Ancylostomatidae
e.g. : Ancylostoma duodenale

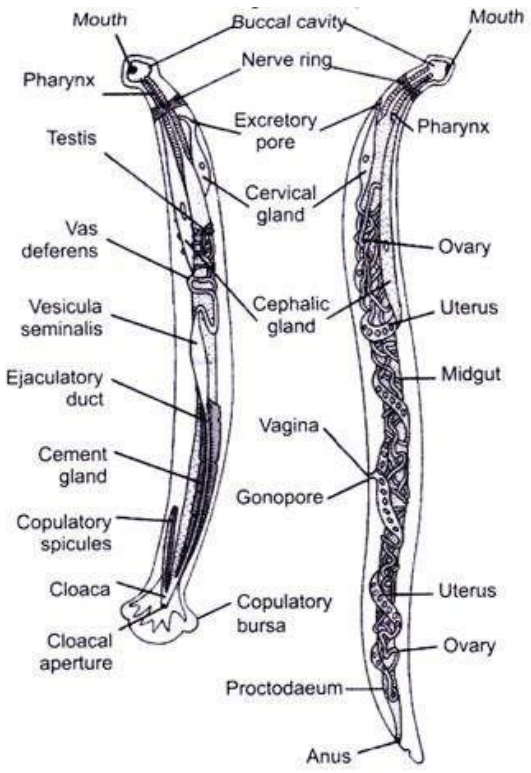


Fig. 9.20 Male and Female *A. duodenale*

habitat : small intestine

Hosts : definitive host (man) intermediate host (none)

Infective stage : filariform larvae