

- **Classification of parasites** with medical importance. The way of transmission of parasites. Vectors of transmission.
- **Conception of parasitism.** Influence of the parasite on the host. The reaction of the host on the parasite invasion.
- **Arthropods with medical importance and their role in infectious pathology and tropical diseases.**
- **Tropical diseases.** Their spread. Infectious diseases associated to the international trip. The principal element of a consultation before a trip in the tropical region.
- **Medical protozoology.** Classification. The principle of diagnosis.

# Parasite:

is an organism that

- lives **on** or **in** a host organism and
- gets its food **from** or **at** the expense of its host
- contributes nothing to the host

There are three **main classes of parasites:**

- I. Medical Protozoa
- II. Medical Helminths
- III. Ectoparasites/Medical arthropod

## **Parasitic infestation:**

external parasitism by ectoparasites (arthropods)

## **Parasitic infection:**

invasion by endoparasites (protozoa / helminths)

## **Parasitic disease:**

invasion and pathology produced by endoparasites

It may be:

- I. sub-clinical latent infection
- II. clinical disease
- III. carrier

## **Medical parasitology:**

➤ studies the medical parasites:

» their morphology

» life cycle

» the relationship with host and environment.

# Arthropods: “Arthro” means jointed and “Poda” means legs

## Common characteristics of arthropods:

- **are invertebrate animals**
- are bilaterally **symmetrical**. **Fly bite**
- bodies are **divided** into a number of rings or segments.
- have jointed **appendages**, which may take the form of legs, antennae, or mouthparts.
- have a body cavity called haemocoel, which contains **haemolymph** that bathes internal organs.
- have a hard chitinous **exoskeleton** (cuticle).
- **moulting** is a phenomenon characteristic of all arthropods whereby the cuticle is shed at regular intervals in order to accommodate the growing tissues.
- use the following **systems** for survival: digestive, circulatory, respiratory, nervous, excretory, reproductive system



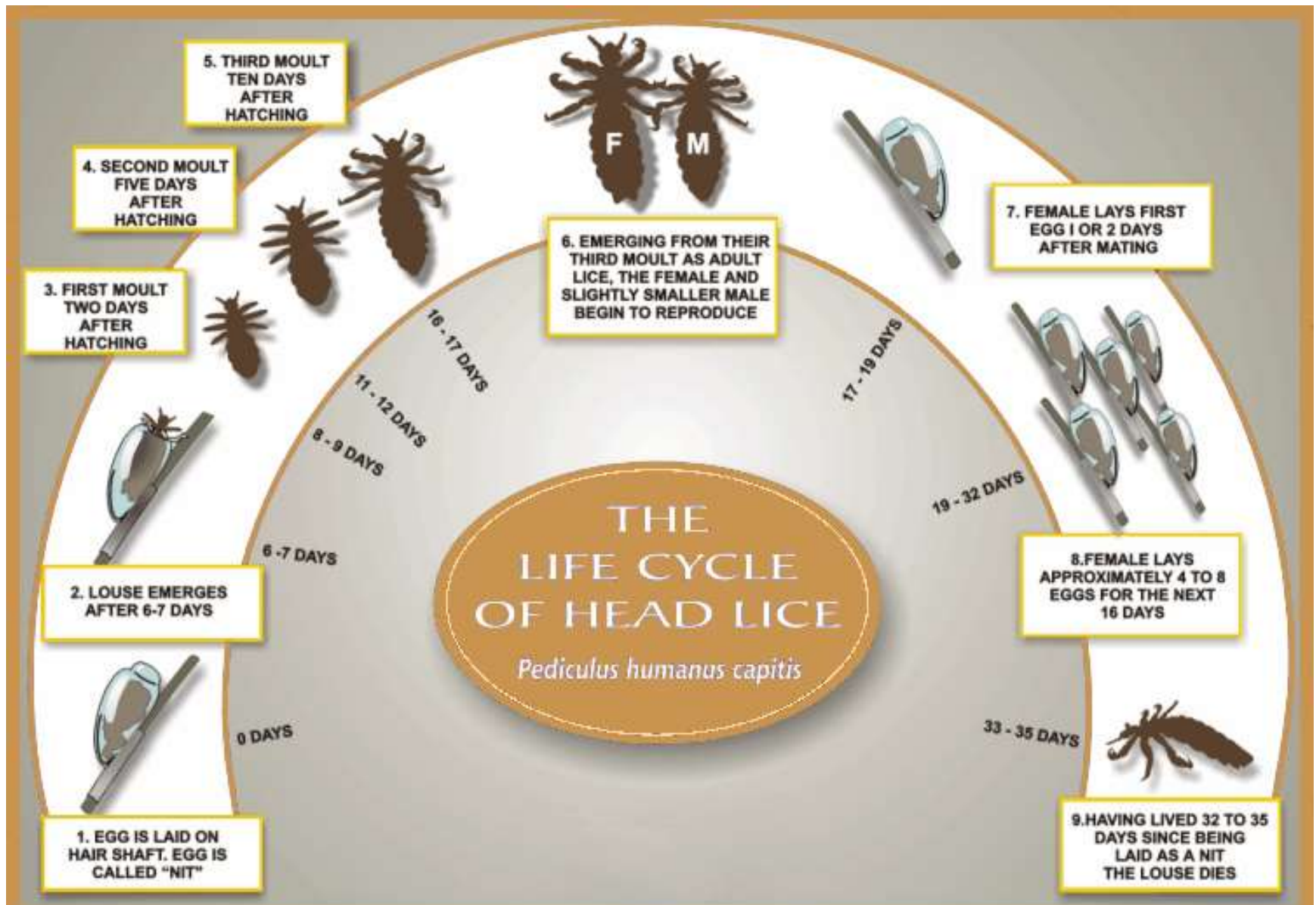
The development of arthropods (metamorphosis) from egg to adult could be:

Incomplete development from the egg to nymph, which looks like the adult

OR

• Complete development: egg ⇒ larva ⇒ pupa ⇒ adult arthropod.

louse



examples of the health effects attributed to arthropods:

- Arthropods attack man, domestic and wild animals.
- They bite and suck blood.
- They pass infective organisms and may inject toxin (mechanically or biologically).
- They cause myiasis (infestation by larva of diptera) on man
- Annoy and irritate
- They cause infestation by bite, sting, spines or by their secretions. The infestation may cause swelling, pain, redness, rash, fever, allergic reactions, blood poisoning, or death in some cases.
- Arthropods parasitize man: for example louse
- Cause accidental injury to sense organs: they enter the eyes, ears, mouth or nostrils.
- They cause allergic/asthmatic reactions by their odor, secretions, and by their dead body fragments.
- • Arthropods cause Entomophobia (fear of insects): nervous disorder, hysterics, hallucination etc.



# Taxonomy (Scientific Classification) of Arthropods

## Phylum Arthropoda

**Class Arachnida** - consists of ticks, mites, spiders, scorpions.

Body divided into cephalothorax (head and thorax fused) and abdomen

4 pairs of legs

body divided into cephalothorax & abdomen

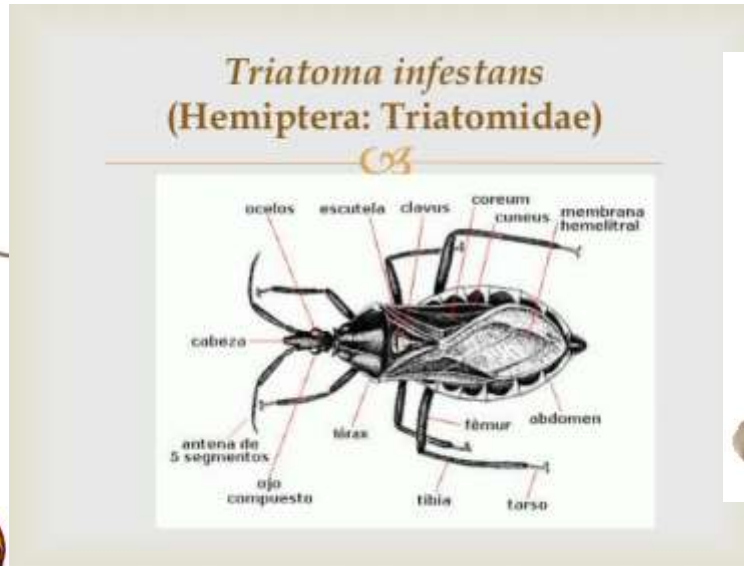
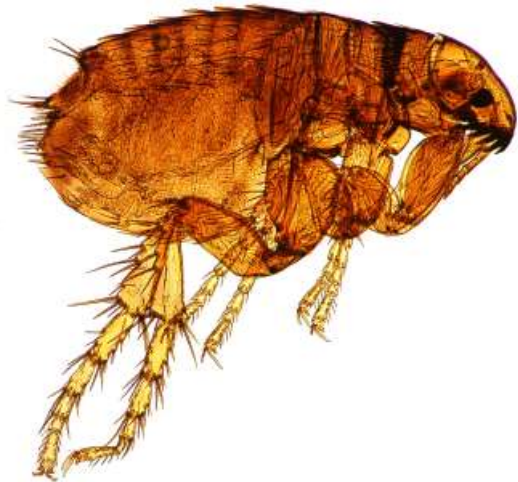
wingless, no antennae

undergo incomplete metamorphosis





**Class *Insecta*** - consists of mosquitoes, fleas, bugs, lice, flies, etc.  
3 pairs of legs one pair of antenna on the head body divided into: head, thorax, abdomen wings may be present and could be one /two pairs



## **Class Crustacea - consists of cyclops.**

Body divided into cephalothorax and abdomen

4 pairs of legs

2 pairs of antenna

Wingless

Most are aquatic



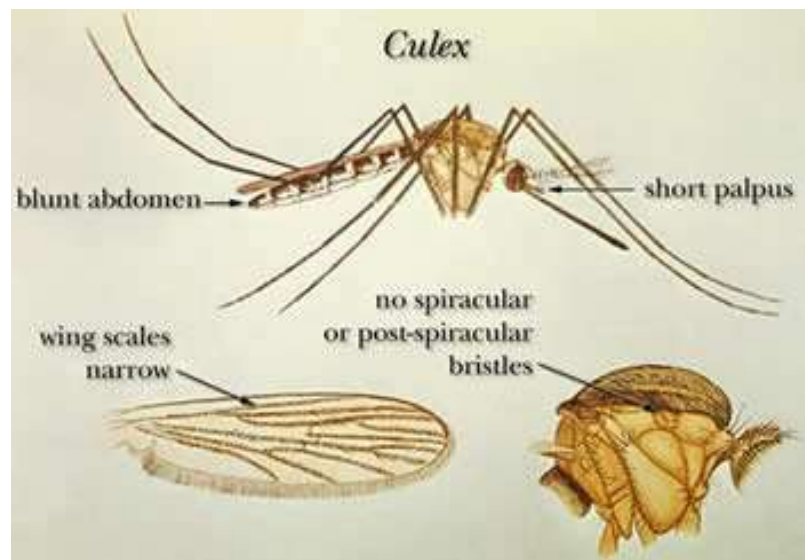
# MOSQUITO RELATED CONDITIONS

**Anopheles mosquitoes** - Plasmodium sp.

Culex mosquito - Wuchereria bancrofti

**Aedes mosquito** - Wuchereria bancrofti, **yellow fever virus**

Mansonia - Brugia malayi



# **FLEA RELATED CONDITIONS**

- rat flea → vector of the plague.



# LICE RELATED CONDITIONS

Sucking lice feed on blood, and their entire life cycle is spent on mammalian hosts

- *Pediculus humanus capitis* – head louse is found only on the hair of the head, sucking blood from scalp
- *Pediculus humanus corporis* – body louse lives on underclothing and feeds on the body. Adults appear about nine days after hatching from the egg
- *Phitrius pubis* – pubic /crab louse is found mainly in the pubic and perianal region of humans, it doesn't transmit disease, however, may cause considerable discomfort, is typically acquired by close contact, usually sexual

Responsible for transmission of diseases:

- relapsing fever and epidemic typhus,



# BUG RELATED CONDITIONS

Triatoma (Kissing bug, Bedbug, assassin bug (killer bug)):

- vary in length up to 100mm
- vector of *Trypanasoma cruzi* in Latin America.



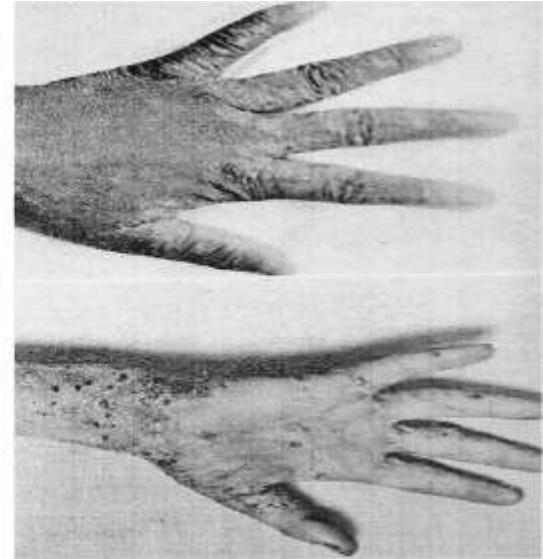
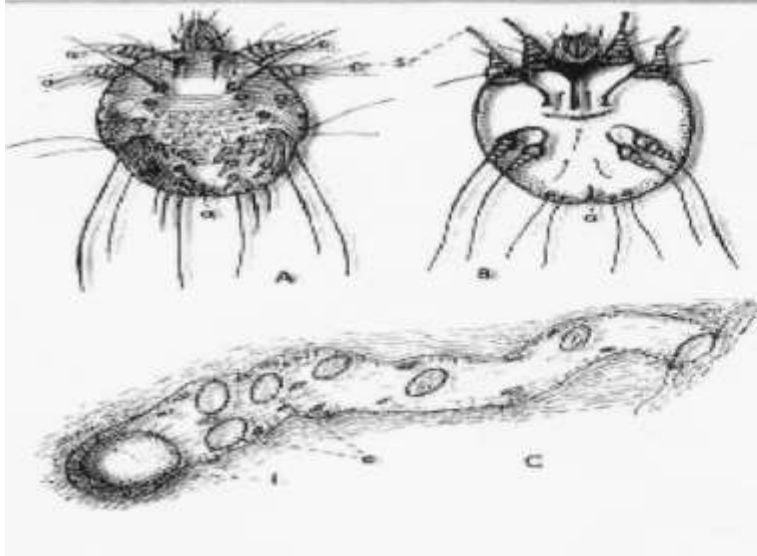
# TICK RELATED CONDITIONS

- mechanical injury to the skin.
- may sometimes produce toxins, which affect release of acetylcholine at the neuromuscular junctions = a progressive ascending paralysis
- transmit diseases:
  - Rickettsial illnesses.
  - Female Rocky Mountain wood tick, *Dermacentor andersoni*.

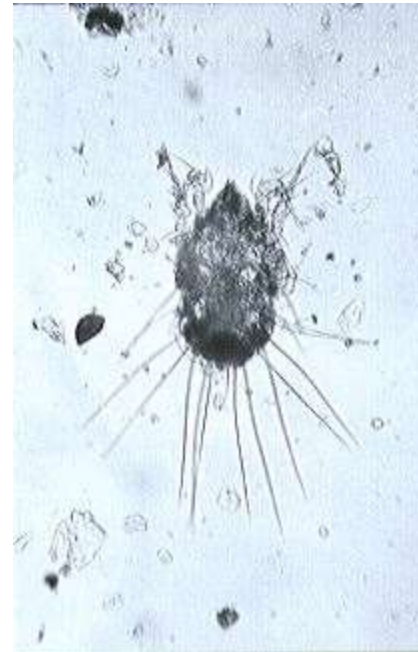


# MITE RELATED CONDITIONS

- *Sarcoptes scabiei* - scabies.



- House dust mites -
- produce or concentrate potent allergens





- **Myiasis** - invasion of tissue of vertebrates with dipterous fly larva
- tropical America and Africa –Tunga penetrance (1 mm in length - burrowing into the skin -may swell to 1 cm, cause extreme irritation)



Figure 1: Larvae of *Chrysomya bezziana* infesting SCC on the face

# **Protozoa**

- » are microscopic, one-celled organisms,
- » can be free-living or parasitic,
- » morphologically and functionally complete.

➤ A single cell carries out all the functions such as:  
digestion,  
respiration,  
excretion,  
reproduction

**Infectious to humans protozoa can be classified into 4 groups based on their mode of movement:**

- I. Sarcodina – the amoeba, e.g., *Entamoeba***
- II. Mastigophora – the flagellates, e.g., *Giardia, Leishmania***
- III. Ciliophora – the ciliates, e.g., *Balantidium***
- IV. Sporozoa – adult stage is not motile e.g., *Plasmodium, Toxoplasma***

# **PATHOGENESIS AND PATHOLOGY**

**Pathogenesis of the parasitic diseases depends on:**

## **Host factors:**

- **nutritional status of the host (malnutrition)**
- **immune response to parasitic infection**
- **immune status of the host (immuno-suppression or not)**
- **presence or absence of the co-existing disease or other physiological conditions (e.g. pregnancy)**
- **age at the time of infection**

## **Parasitic factors:**

- **site of the attachment of the parasite**
- **size of the parasite**
- **number of invading parasites**
- **parasite strain (pathogenic or non-pathogenic) and the growth, development and multiplication of parasites inside the human body and their metabolic products.**

## **The parasites can cause diseases in various ways:**

- trauma by adult worm, larva, and egg
- invasion and destruction of host cell (production of several enzymes which cause digestion and necrosis of host cells)
- inflammatory reaction (formation of granuloma)
- toxic reaction (but they appear to have a minimal role in the pathogenesis of the disease processes)
- allergic manifestation

## **Parasites can survive in host by the mechanisms:**

- ⇒ intracellular location (*Toxoplasma, leishmania*)
- ⇒ antigenic shedding (*Entamoeba, Toxoplasma, Fasciola*)
- ⇒ antigenic variation (*Trypanosoma*)
- ⇒ antigenic mimicry (*Schistosoma*)
- ⇒ modification of host immune responses:
  - by inactivation of complement
  - immune suppression
  - modified leucocyte function and immune complex.

# **Protective immune responses:**

## ➤ ***Sterilizing immunity***

- » **complete elimination of the parasite from the host and life long resistance against subsequent infection.**

## ➤ ***Incomplete immunity***

- » **clinical recovery from the disease and the development of immunity to specific challenge of the parasite.**
- » **parasites always persist in the host at a low level**
- » **typically found in many protozoal infections**

***Tropical diseases.*** *Their spread. Infectious diseases associated to the international trip. The principal element of a consultation before a trip in the tropical region.*

Advice to travellers is based on the:

- countries intended to visit,
- location (urban vs. rural),
- current health status (e.g. pregnancy, immunocompromise),
- duration of stay,
- previous medical history (e.g. splenectomy).

Previously, tropical infections were almost exclusively a health problem in developing countries with poor sanitation.

The increasingly diagnose in the developed countries:

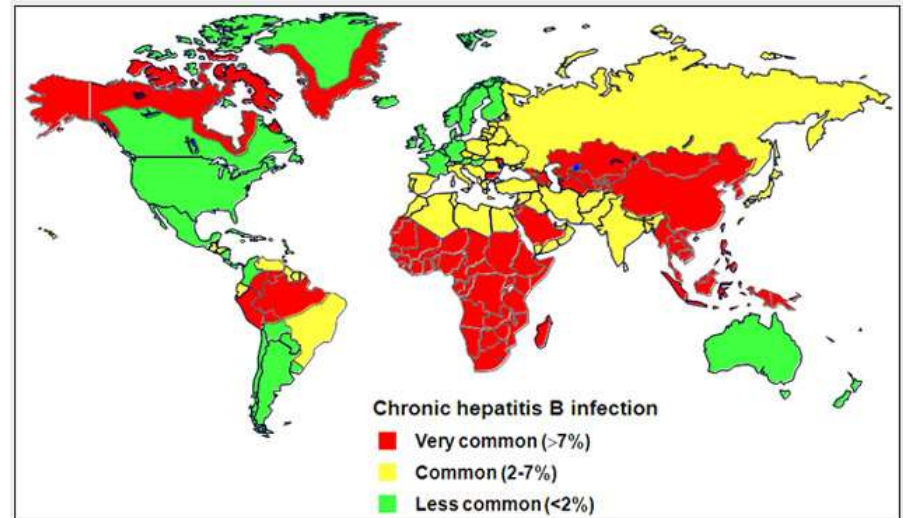
- current marked rise in international travel
  - increased military deployments to endemic areas
  - global climate change may impact the incidence of parasitic / tropical infections in humans
  - The incidence of symptomatic parasitic infections has also increased because of:
    - the ever-increasing population of immunocompromised hosts:
      - organ transplant,
      - cancer chemotherapy,
      - infection with HIV
- allowing dormant parasites to reactivate

## Immunization for foreign travel

- Polio, tetanus and diphtheria immunization should be reviewed, and a course or booster given if required, regardless of destination
- Travellers to areas of poor hygiene usually require immunization against typhoid, hepatitis A and yellow fever for entry to some high-risk countries



 High endemicity     
  Medium endemicity     
  Sporadic outbreaks



Map 2.3 Yellow fever endemicity zones in Africa, 2009

