Medical Entomology (Medical Arthropodology):

Arthropodes*:* (Phylum Arthropoda)

These organisms are characterized by :

1. Jointed legs,
2. Body segments ,
3. A hard outer covering or exoskeleton made of chitin(Chitinized exoskeleton).
4. Bilaterally symmetric body with jointed appendages.
5. Hemocele: the body cavity serves as blood cavity simultaneously.

Classification : Phylum Arthopoda contains the following Classes :

1. **Insecta** (insects),
2. **Arachnida** (spiders, mites, ticks, scorpions, etc),
3. **Chilopoda** (centipedes) e.g. scolopendra
4. **Diplopoda** (milipedes), and
5. **Crustacea** (crabs, shrimp, lobsters, water fleas, etc).

The impairment of arthropods to humans:

1) Direct impairment:

A. harassment and blood sucking
B. sting and inoculation of poison
C. allergic reaction
D. parasitism : such as myiasis, scabies, etc.

2) Indirect impairment:

a) Mechanical transmitting vector:

They play the role as a passive carrier of pathogens.

b) Biological transmitting vector:

The arthropod is used by pathogens not only as a vehicle but also as an environment for development and/or reproduction to their infective stages.

How to judge an arthropod as a transmitting vector? (four evidences):

1. Biological evidence: (closely related with humans, dominant species, longer life span)

2. Epidemiological evidence: (closely related with distribution epidemic region and season)

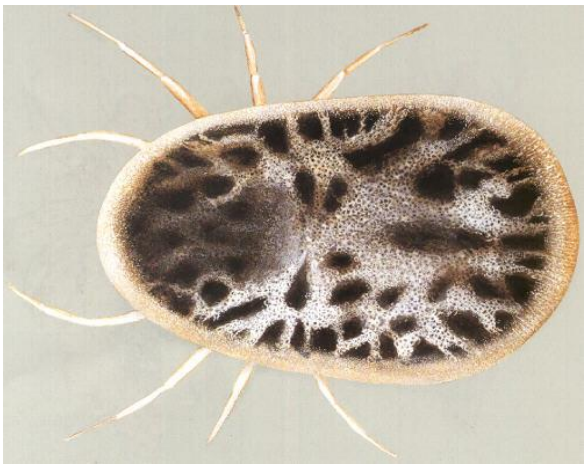
3. Evidence of natural infection: (pathogen isolated from the vector).

4. Laboratory evidence (Artificial infection).

Ticks and mites:

Morphology:

- Gnathosoma
- Idiosoma
- 4 pairs of legs
- (Adult)



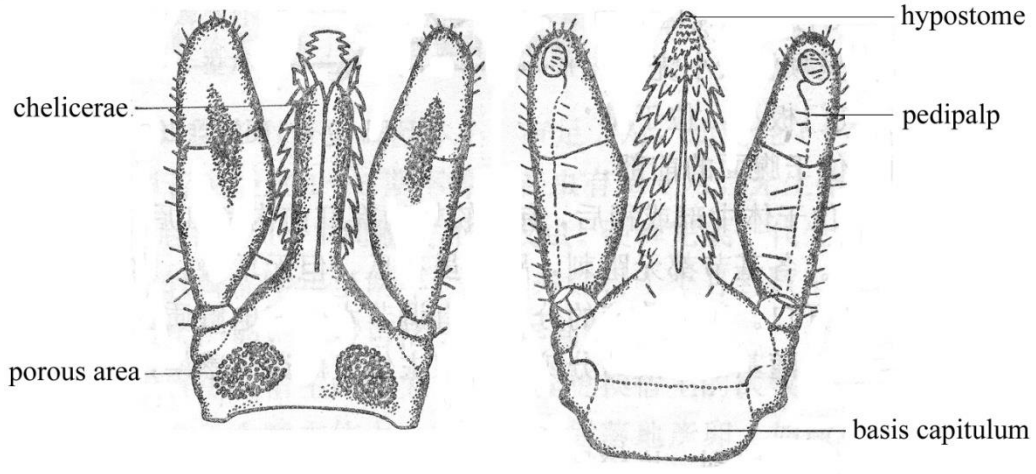
Life cycle:

- **Egg ----- larva---- nymph---- adult.**

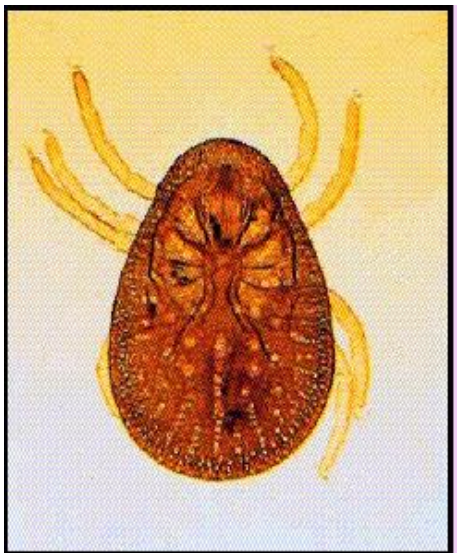
Hard ticks:

- Note: scutum on its back
- Male (left), Female (right)
- Gnathosoma of hard ticks.
- (a) dorsal view.
- (b) Ventral view.
- Note:
- hypostome .

- pedipalps.
- The mouthparts is composed of chelicerae and hypostome.



Soft tick: Without scutum



The relationships with diseases:

- **Direct impairment:**

1. sting and blood sucking.
2. tick paralysis (caused by the poison of ticks to nervous system).

- **Indirect impairment:**

1. Forest encephalitis (viral disease)
2. Xinjiang hemorrhagic fever (spirochaetal disease)
3. Lyme disease (spirochaetal disease)
4. Tick-borne relapsing fever (spirochaetal disease)
5. Q-fecver (rickettsial disease)
6. North Asia tick-borne typhus (rickettsial disease)
7. Others : bacterial diseases (the plague, tularemia,etc.)
8. Tick-borne parasitic disease (Babesiosis)

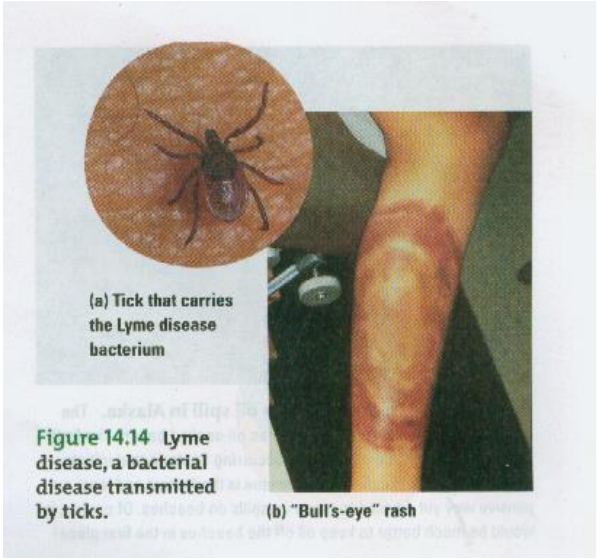
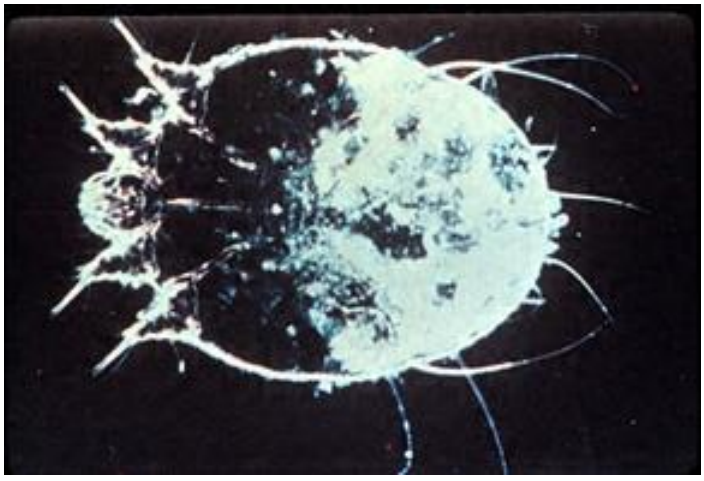
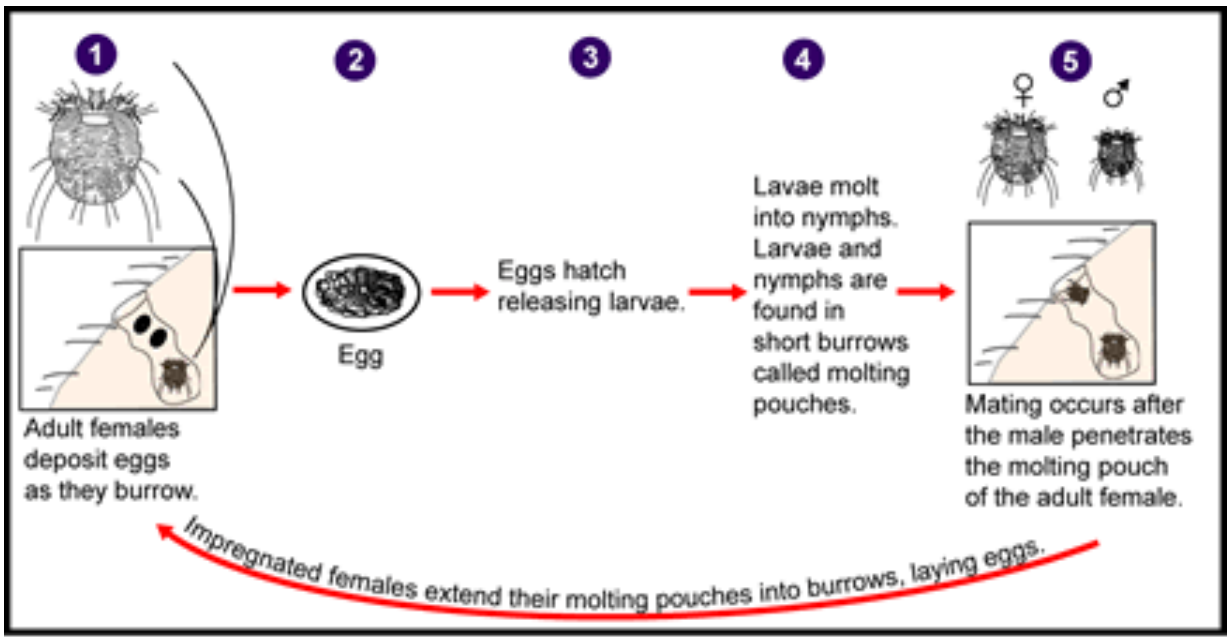


Figure 14.14 Lyme disease, a bacterial disease transmitted by ticks.

Scabies mite (Sarcoptes scabei):

Scabies **mite** is the cause of scabies and is distributed worldwide.

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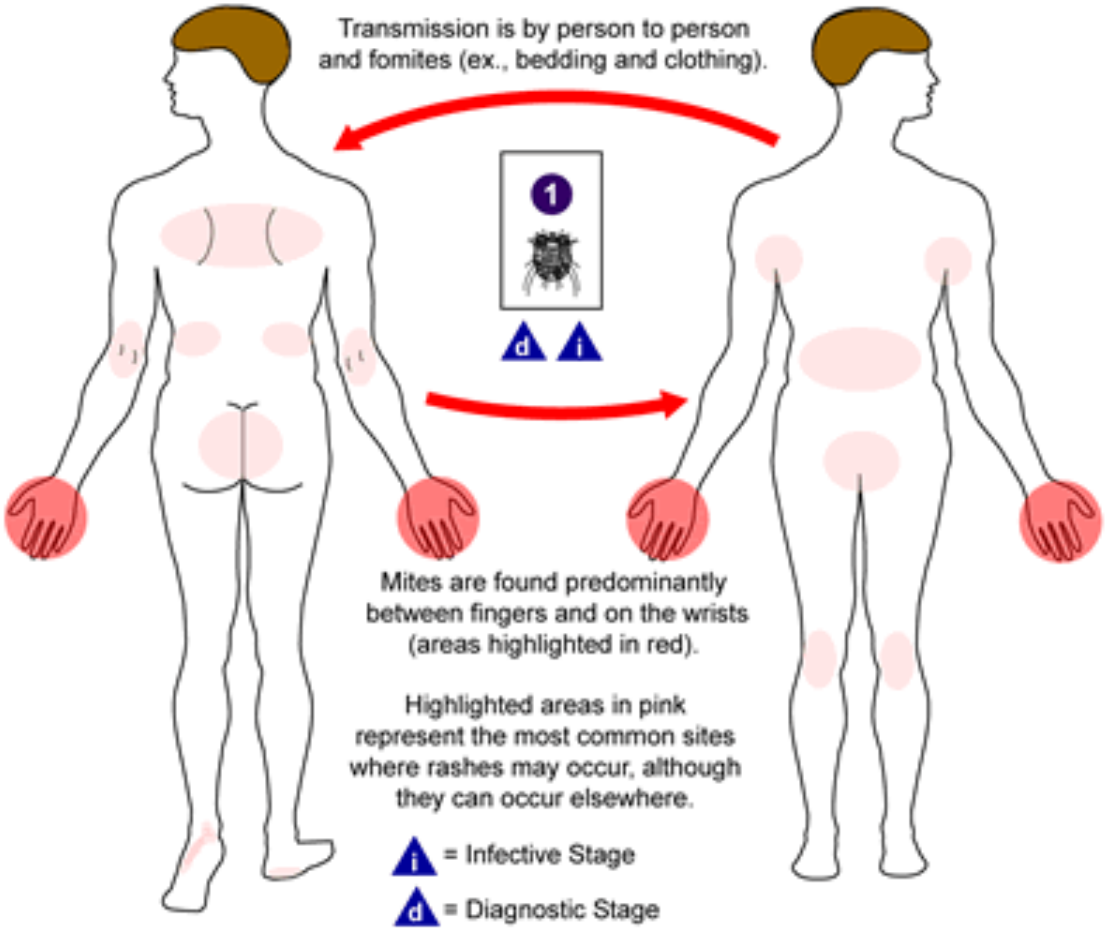
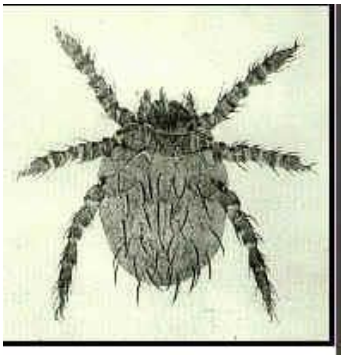
Adult females deposit eggs as they burrow.
Egg
Eggs hatch releasing larvae.
Lavae molt into nymphs. Larvae and nymphs are found in short burrows called molting pouches.
Mating occurs after the male penetrates the molting pouch of the adult female.
Impregnated females extend their molting pouches into burrows, laying eggs.


Transmission is by person to person and fomites (ex., bedding and clothing).
1
d
i
Mites are found predominantly between fingers and on the wrists (areas highlighted in red).
Highlighted areas in pink represent the most common sites where rashes may occur, although they can occur elsewhere.
i = Infective Stage
d = Diagnostic Stage

Scabies:

Chiggers (Harvest mites):

Only Larva stages suck blood and transmit disease . Note: larva has 3 pairs of legs.



Relation to diseases:

1. Dermatitis (trombidiosis)

2. Scrub typhus (rickettsail disease) (Tsutsugumashi disease).

3. hemorrhagic fever (viral disease).

❑ **Demodex (follicle mites):**

D. brevis (in sebaceous gland)

D. folliculorum (in hair follicle)

They are common mites found in humans. Opportunistic pathogenic mites in forehead , nose naso-labial groove, head skin, cheek and ear-hole etc. Folliculitis or skin lesion.

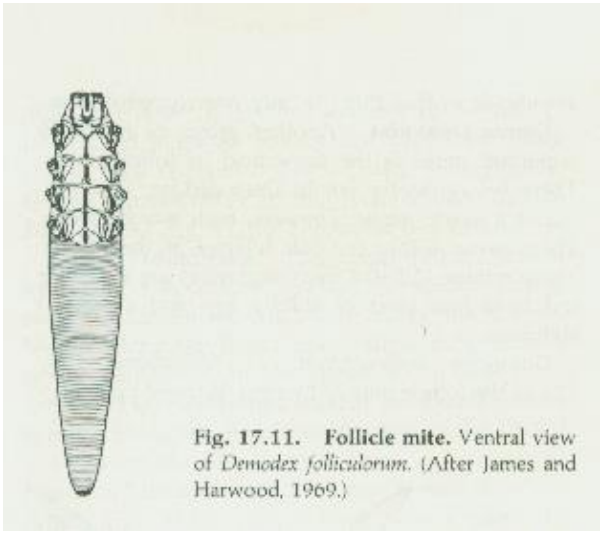


Fig. 17.11. Follicle mite. Ventral view of *Demodex folliculorum*. (After James and Harwood, 1969.)

Medical insects (Insecta):

- **Characteristics:**

❑ The body: head , thorax and abdomen

❑ A pair of antennae

❑ Three pairs of legs (adult).

- **Metamorphosis of insects:**

All changes from larva to adult is called metamorphosis including morphology, physical functions, living habit, behavior and instinct.

- **Complete metamorphosis :**

Four stages in the life cycle (egg --- larva ---- pupa--- adult)

- **Incomplete metamorphosis :**

Without pupal stage.

Morphology:

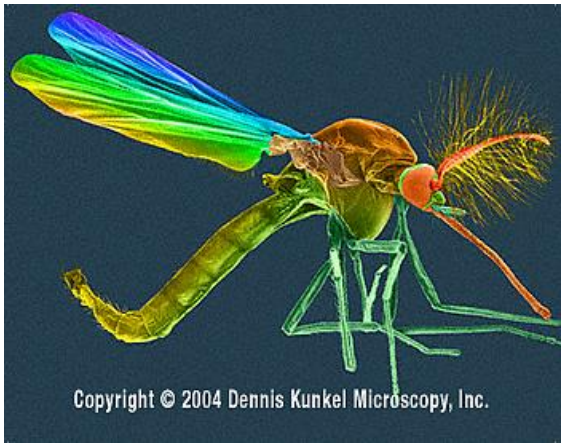
- **Head:**
- **A pair of antennae (olfactory and tactile sensation)**
- **A pair of compound eyes, some with single eyes (ocelli)**
- **Three types of mouthparts:**
- **1 chewing mouthparts (cockroach)**
- **2 lapping mouthparts (housefly)**
- **3 piercing-sucking mouthparts (mosquito).**
- **Thorax**:
- **Prothorax Mesothorax and Metathorax**
- **Three pairs of legs**
- **a pair of wings**
- **Abdomen:**
- **segmented**

Genitalia is important for identification.

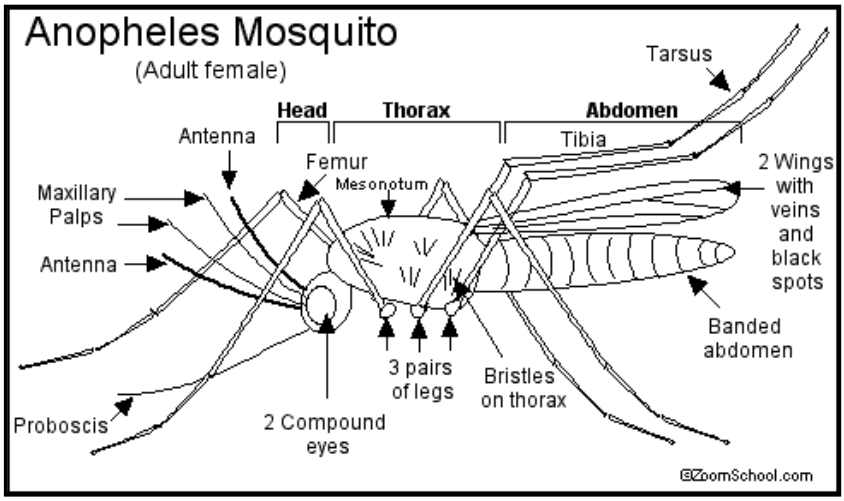
Mosquitoes:

Three important Genus:

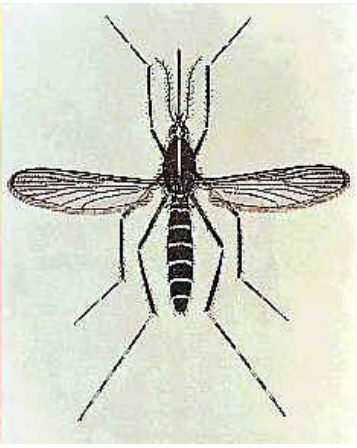
1. *Anopheles*
2. *Aedes*
3. *Culex*



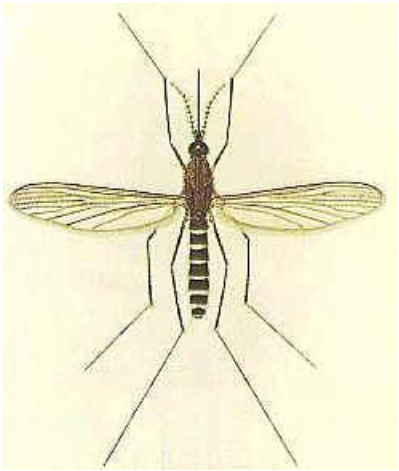
❑ Morphology Anopheles:



Aedes:

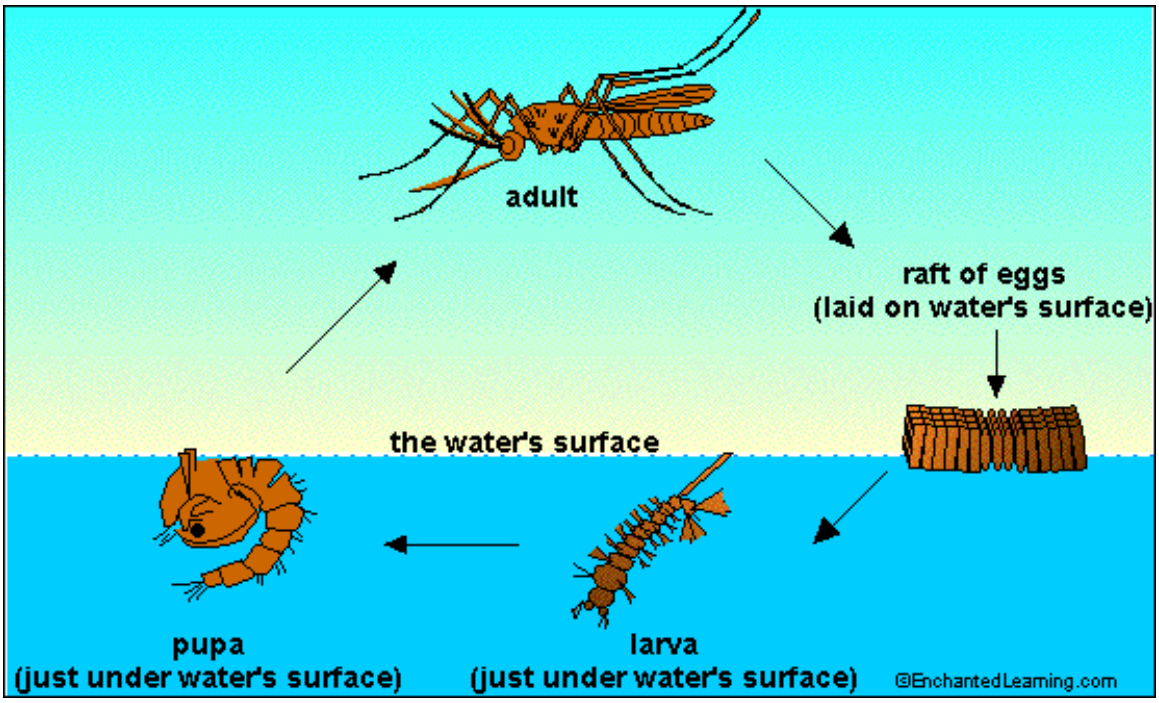


Culex:



Species	Anopheles	Culex	Aedes
Egg	boat-like with float (Surface)	conical in Raft (surface)	Fusiform single (Bottom)
Larva	2 spiracles Palmate hair (float hairs)	siphon	siphon
Adult (resting position)	Scales body forms an angle to resting place	Body is parallel to resting place	Body is parallel to resting place

Life cycle:



Larvae and pupa:

Relationships to diseases:

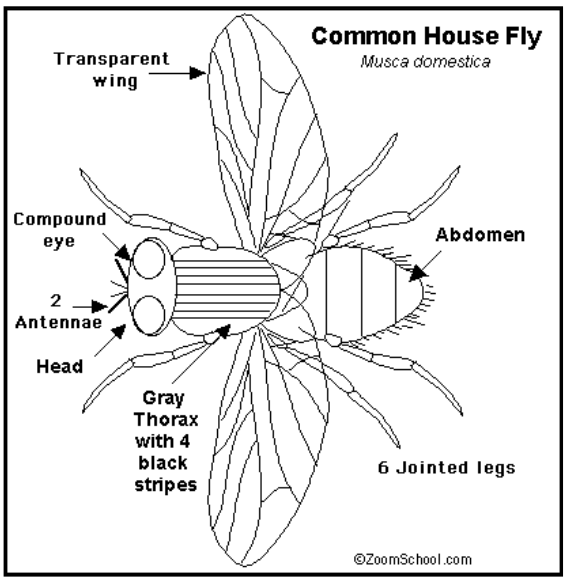
A. **Malaria**

B. **Filariasis**

C. **Japanese B encephalitis**

D. **Dengue fever (viral disease)**

E. **Others: Yellow fever, West Nile, etc.**



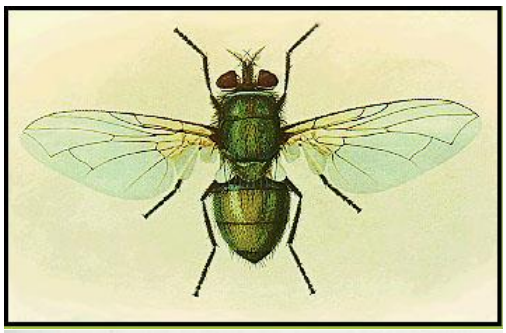
Flies:

Mainly as mechanical transmitting vectors.

Complete metamorphosis.

Life cycle:

Egg , larva(maggot) , pupa and adult.



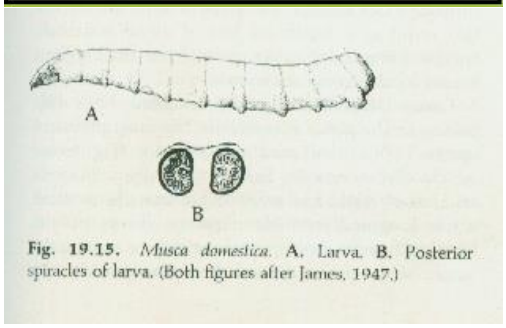
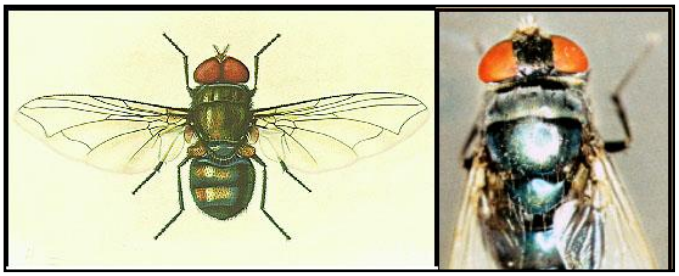


Fig. 19.15. *Musca domestica*. A. Larva. B. Posterior spiracles of larva. (Both figures after James, 1947.)

Feeding habit:

1.Omnivorous(most)
2.Blood sucking (a few)
3.Eating frequently
4.Vomiting and excreting simultaneously



Relationships to diseases:

*****Mechanical transmitting vector:

Bacterial, viral, protozoal diseases, And helminthiasis.

*Biological transmitting vector:

Tsetse fly in Africa (protozoon)

Black fly (river blindness)

Day –biting fly (loaiasis)

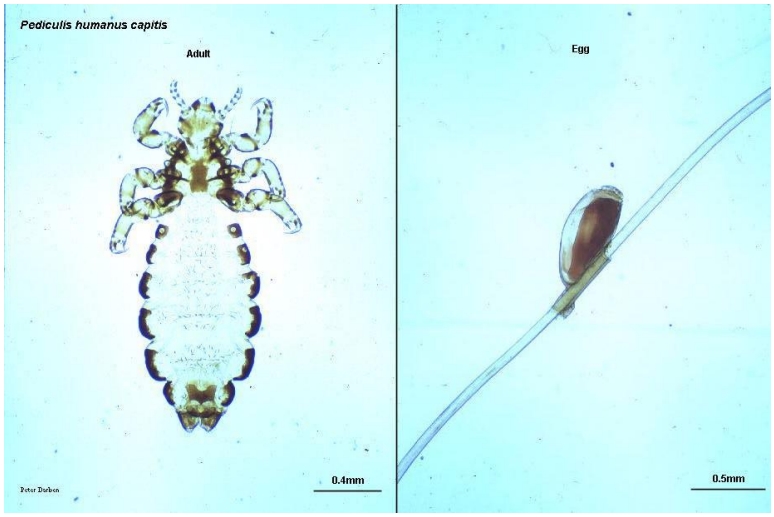
- **Myiasis :**

some flies' larvae parasite in human tissues or organs.

- **Lice**
  - **Body louse**
  - **Head louse**
  - **Crab louse**

Head louse:

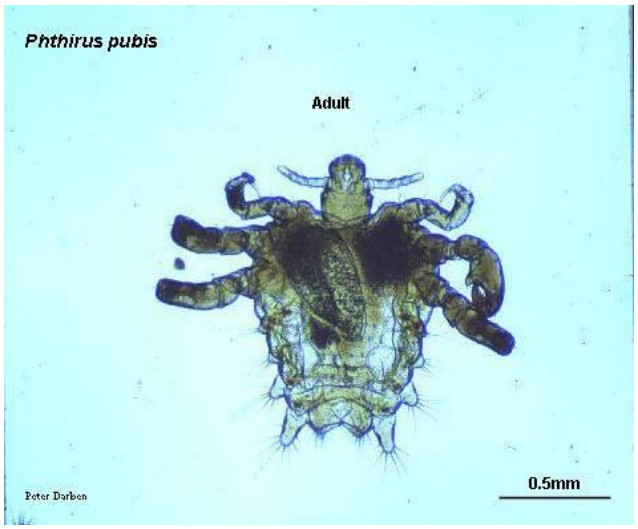
The body louse is similar to the head louse except that it is found on the body and clothes.

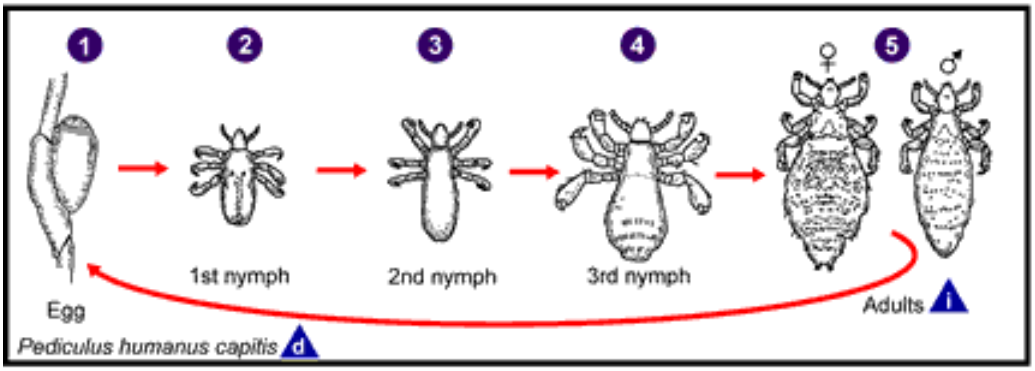


Life cycle:

Egg (nit) --------- nymph ---------- adult

Crab louse: (pubic louse)

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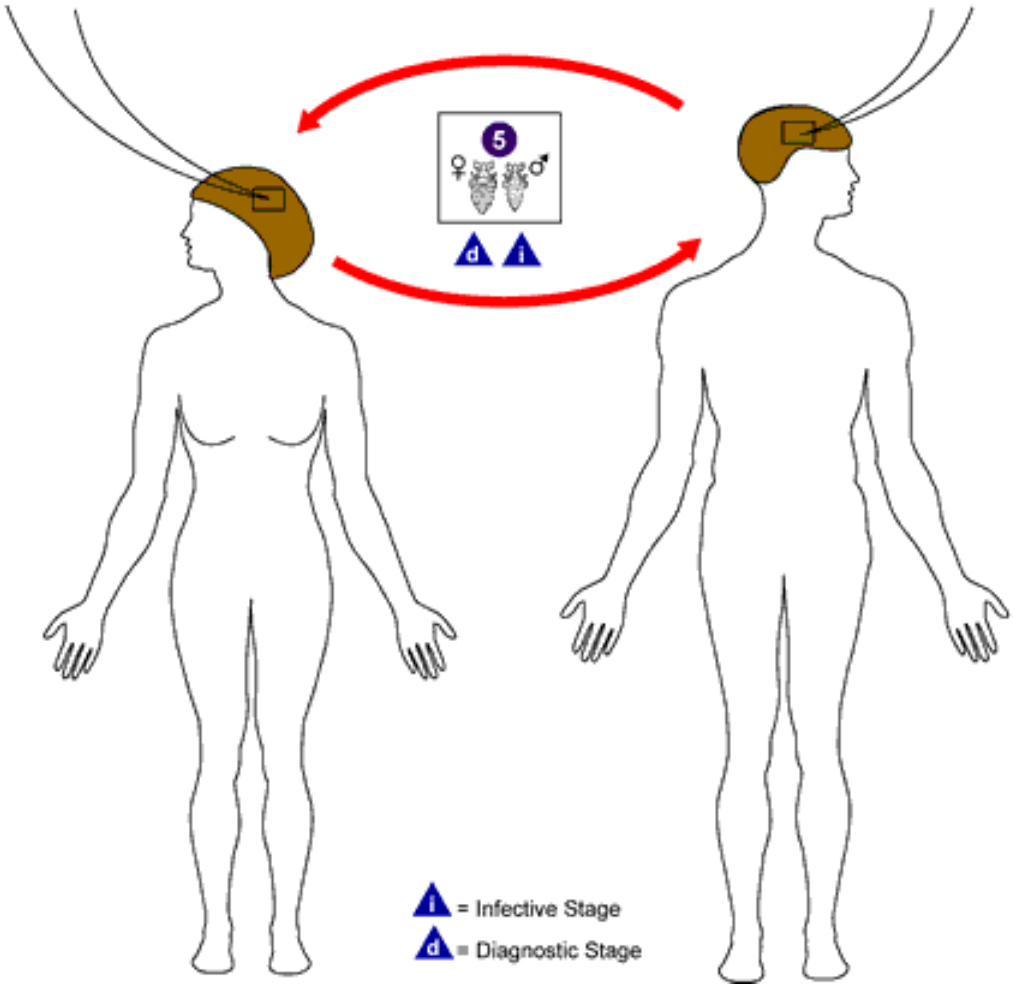
1st nymph
2nd nymph
3rd nymph
Egg
Adults
i
Pediculus humanus capitis
d


5
♀
♂
d
i
i = Infective Stage
d = Diagnostic Stage

Diseases:

1 Epidemic typhus (Rickettsial disease)

2 Trench fever(Quintan fever) Rickettsial disease

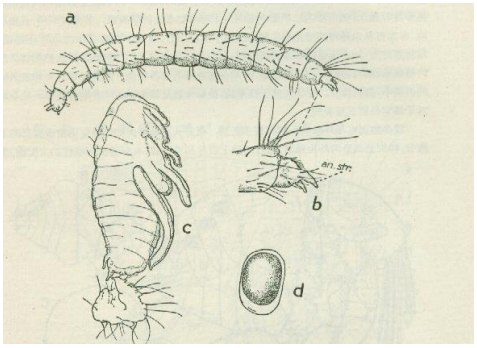
3 Relapsing fever (Spirochaetal disease)

Fleas:

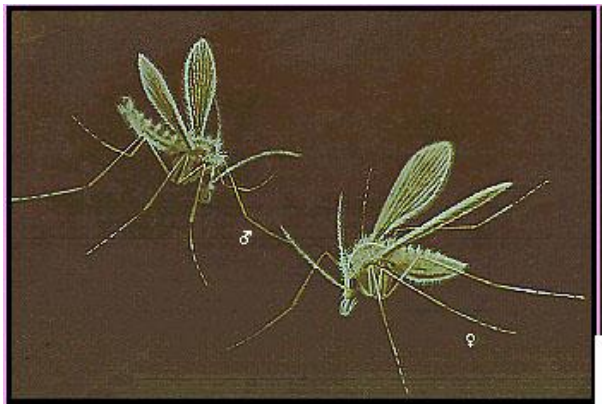
1 The plague (black death)*Yersiinia pestis.*

2 Endemic typhus (rickettsial disease) .

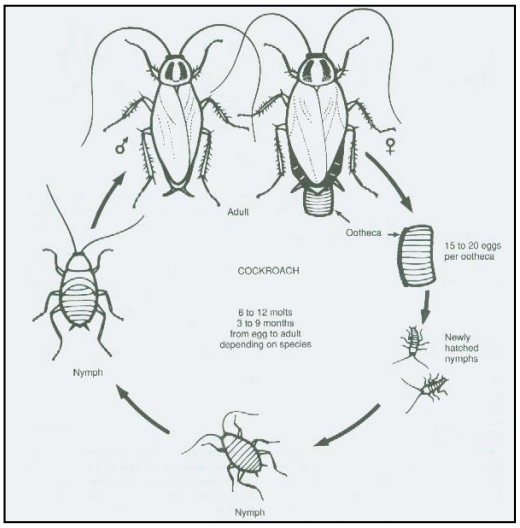
3 As intermediate host of some tapeworms.



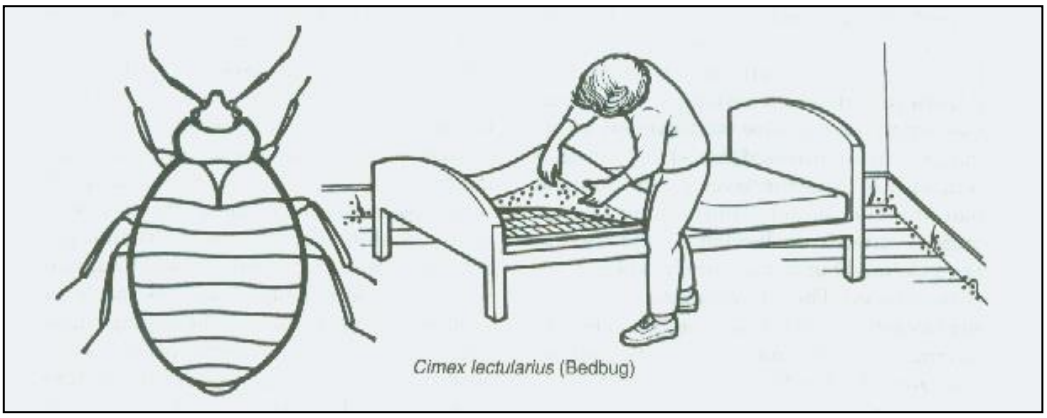
Sand fly:



Cockroach:

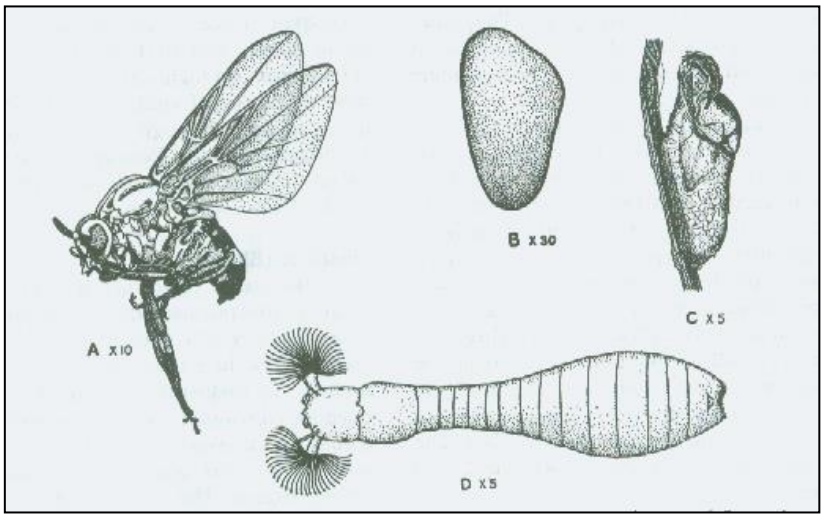


***Cimex lectularius* (bedbug):**



Blackflies:

Blackflies are important transmitting vectors of onchocerciasis (river blindness) in Africa.



Spiders:

Two notorious spiders poisonous for humans.

A: Black widow spider. Note "hourglass" on abdomen

B: Brown spider. Note "violin" on cephalothorax .

- ***Latrodectus*** is a genus of spider in the big spider family Theridiidae, most of which are commonly known as **widow spiders**. The genus contains 31 recognized species[2] distributed worldwide, including the North American black widows (*L. mactans*, *L. hesperus*, and *L. variolus*), the button spiders of Africa, and the Australian redback. Species vary widely in size. In most cases the females are dark-colored and readily identifiable by reddish hourglass-shaped markings on the abdomen. The venomous bite of these spiders is considered particularly dangerous because of the neurotoxin latrotoxin, which causes the condition latrodectism, both named for the genus. The female black widow has unusually large venom glands and its bite can be particularly harmful to humans. However, despite the genus' notoriety, *Latrodectus* bites are rarely fatal. Only female bites are dangerous to humans.
- The prevalence of sexual cannibalism, a behavior in which the female **eats the male** after mating, has inspired the common name "widow spiders.
- Due to the presence of latrotoxin in their venom, black widow bites are potentially dangerous and may result in systemic effects (latrodectism) including severe muscle pain, abdominal cramps, hyperhidrosis, tachycardia, and muscle spasms.[14] Symptoms usually last for 3–7 days, but may persist for several weeks