THE INSECTS

Orders of the Insecta:

Morphology:

1. **Exoskeleton** : In insects, their body covering has been modified into a solid structure, the many – layered exoskeleton or integument. Basically, the integument consists of a basement membrane, a layer of epidermal cells, an externally secreted layer and the cuticle, which contains up to one-half the dry weight of an insect. One of the major compounds within the arthropod cuticle is chitin, a polymer of N-acetyl-D-glucosamine which is closely related to cellulose
2. **Body Divisions** of Insects The body of all insects is divided into three parts: the head, the thorax and the abdomen.
   - ❖ The head of an insect comprises of the anterior or first body region. Its principal parts are the head capsule which contains the brain, mouth parts, the two compound eyes, the simple eyes and the two antennae (sensory organs).

   Types of mouth:
   - Chewing mouth parts: The chewing mouth parts are possessed by insects that grind up and swallow their food.
   - Sponging mouth parts: Sponging mouth parts are adopted for use in eating liquid or readily soluble foods.
   - Piercing-sucking mouth parts –are possessed by insects such as mosquitoes, assassin bugs, stable flies, sucking lice and fleas. These insects pierce the skin of animals in order to suck the blood from them.
   - Cutting-sponging: This is restricted to a limited number of adult flies feeding as parasites up on blood from mammal hosts. Black flies and horse flies are good examples.
   - Siphoning: Almost every naturalist has observed a butter fly or moth land up on a flower, uncoil, and extend its proboscis. If nectar is present, this fluid is sucked in to the body.
   - Chewing-lapping: adult honey bees and bumblebees have mouth parts that are modified in still another fashion in order to utilize liquid food.
   - Rasping-sucking: This type of mouth part appears to be an intermediate between the chewing and piercing-sucking types.

❖ The Insect Thorax

The thorax is composed of three segments: the Prothorax (the anterior portion), the Mesothorax (the middle portion), and the Metathorax (the posterior portion). The wings when present are attached to the mesothorax and metathorax.

The legs In most adult and nymphal insects, segmented fore, mid and hind legs occur on the prothorax, mesothorax and metathorax, respectively.

The Wings Insect wings are flap-like extensions of the body with an upper and lower wall, or membranes. Supporting Veins run between these membranes. Veins that run from the wing base to the apex are called Longitudinal Veins. Lines connecting two longitudinal veins cross wise are called cross veins.

❖ The insect Abdomen

The posterior body region in insects is called the abdomen. This is the third and usually the largest region of the body composed of a series of similar segments variable in number which bear the outside openings to the breathing system called spiracles, the opening of the reproductive organ, the anal opening and sensory organs. The number of segments varies from nine to eleven.

Insects classification :

The insecta (hexapoda) constitute the largest class in numbers of species in the phylum arthropoda, which in turn comprises of a greater number of species than all other phyla of the animal kingdom combined. Various estimates of described species of insects in the world range from 625,000 to 1500000.

The number of described species of important orders of insects:

1. Diptera : Flies, gnats, mosquitoes
2. Anoplura : sucking lice
3. Mallophaga: Chewing lice
4. Hemiptera : True bugs
5. Siphonaptera : Fleas
6. Hymenoptera : Ants, bees, wasps
7. Lepidoptera : Butterflies, moths

8. Orthroptera : Grasshoppers, Crickets

9. Coleoptera : Beetles, weevil's

10. Dictyoptera: Cockroaches

11. Isoptera: Termites

Order Diptera

Members of the order diptera are a diverse group in both structure and development. These include all the flies, gnats and mosquitoes. Beyond their having a single pair of wings (the hind are reduced to balancing organs called halters) and all being homometabolic, the suborder have quite different patterns of development and structures. There are over 85000 species of dipterans in 140 families .

The insects grouped into the order diptera are the two winged (di = two; ptera = wings). The wing could be used as a classifying factor. As insects, they are with three body division (head, thorax, and abdomen). All these insects are characterized by having only one pair of wings; the hind pair has degenerated, therefore, all that remains is a pair of drumstick-like organs, the halters, used for balance in flight.

Dipterans are important to humans for a variety of reasons, many flies are pests. In addition, many serve as either mechanical or biological vectors of infectious agents.

- Tse tse fly transmits the agent causing African sleeping sickness
- mosquito transmits malaria, lymphatic filariasis, and hundreds of viruses
- biting midges transmit filarioid nematodes and viruses such as blue tongue virus
- tabanids transmit tularemia.

Since these flies are blood-suckers, they can be serious pests regardless of whether they are vectors of infectious agents. Many flies are parasitic as larvae; they can be serious medical and economic problems .

Diptera are only able to take fluid food, which in the case of bloodsucking flies is obtained by injecting the piercing mouthparts (proboscis) into living tissue. In other flies, food is liquidized externally by puddling it with spongy mouth parts in digestive fluid regurgitated from the foregut (crop)

All Diptera go through a complete metamorphosis in their life cycle, developing from the egg through a number of larval stages to the pupa from which the adult emerges. The larva, which is the feeding and growing stage, is typically found in a completely different environment from the adult, although the adult will be associated with the larval environment when mating and laying eggs.

A large group within the diptera, sometimes known as the calypterate flies (because the halters are shielded from above by saucer-like processes known as calypters), includes houseflies (musca species), bluebottle (calliphora species), green bottle (lucilia species),

They are small to moderate, wings restricted to mesothorax, and metathorax. Mouth parts vary from non-functional to biting and sucking. Immature stages (larvae, maggots) variable, without jointed legs, with sclerotized head capsule or variably reduced ultimately to remnant mouth hooks. Mouth parts of diptera vary into two aspects:

- Those having spongy (non-biting) mouth parts and not able to penetrate into the skin. Example Male mosquitoes
- Groups with biting mouth part/piercing and sucking type. These are with sharp mouth parts (proboscis) for piercing the skin and blood sucking; so important biological vectors; example. Tse tse fly, female mosquitoes,

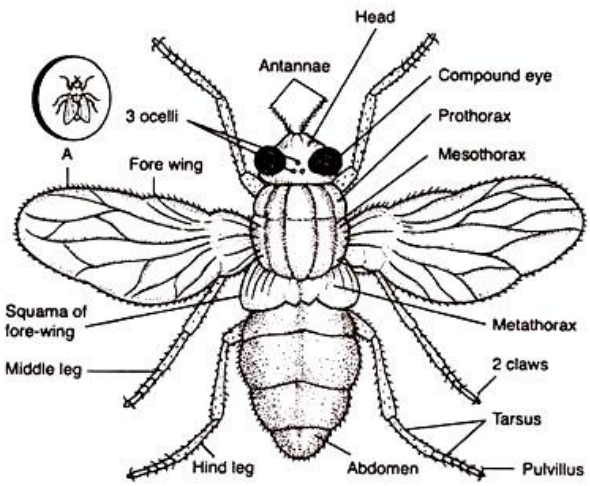


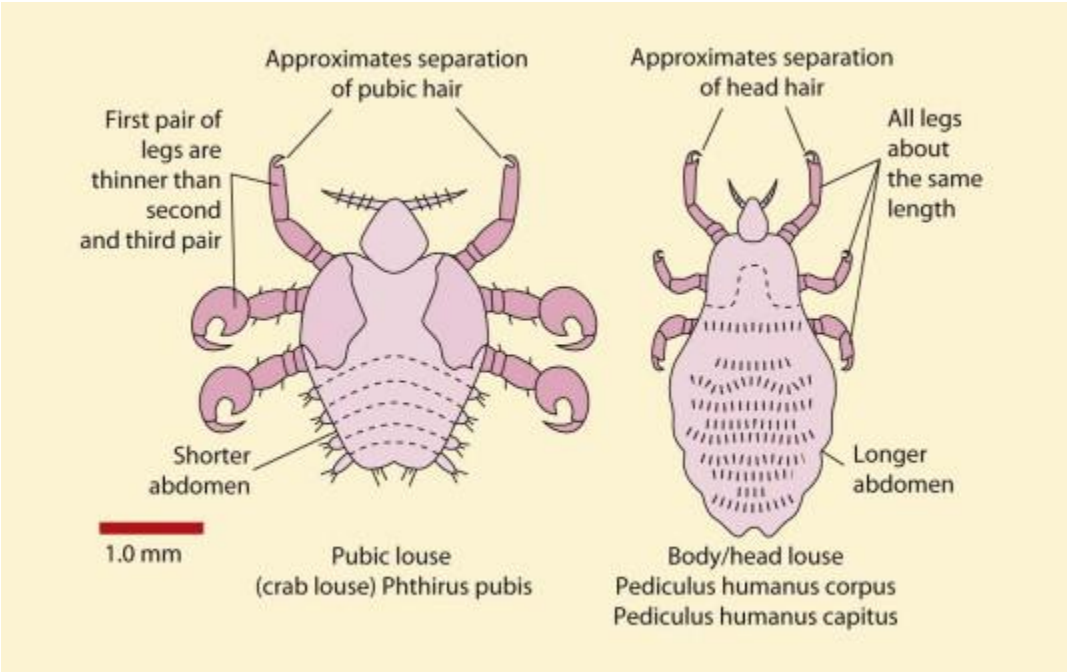
Fig. 15.20: External anatomy of *Musca domestica*

Order Anoplura.

Anoplura 'a' means without, 'oplas' means sting, and 'oura' means tall. These are the sucking lice.

- They are minute to small (from 0.4 to 6.5 mm) and may be characterized by their narrow than long head, two to five segmented antennae, piercing-sucking mouthparts that are retracted into head, greatly reduced eyes, absence of wings and cerci, and dorsoventrally flattened body.
- The legs are short, and the single tarsus and claw are modified into a grasping organ .

- Sucking lice feed on blood, and their entire life cycle is spent on mammalian hosts.
- Metamorphosis is incomplete (gradual).
- Eggs are glued to the hair of the host.
- A high degree of host specificity and preference for specific regions on the host are recognizable.
- The human louse, Pediculus humanus, infests humans, and whether it feeds on the head or body region has direct influence on its morphology and behavior (these two varieties, head (**Pediculus humanus capitis**) and body lice (**Pediculus humanus corporis**), sometimes treated as two separate species). They are very similar in appearance, but biologically they are very different; the head louse is found only on the hair of the head, sucking blood from scalp, where as the body louse lives on underclothing and feeds on the body.
- Adults appear about nine days after hatching from the egg. The crab louse, Pthirus pubis, another species found in man is found mainly in the pubic and perianal region of humans. The pubic louse doesn't transmit disease. However, an infestation known as phthiriasis or 'crabs' may cause considerable discomfort and sometimes embarrassment, since it is typically acquired by close contact, usually sexual intercourse, with an infested person. Prevalence of louse in the human population is a sign of poverty and unhygienic life.



Order Mallophaga

These are the chewing lice. They are small (from 2 to 6 mm) and have a head usually broader than long, modified chewing and piercing mouthparts, reduced compound eyes, two to five segmented tarsi, no cerci, and lack wings.

The body is flattened dorosoventrally. Eggs are fastened to feathers or hair of the host. Metamorphosis is incomplete (gradual).

Both nymphs and adults ingest dead skin, feather, hair, or scabs. Under high population pressures, the dermal skin layer also may be attacked, particularly around wounds. The chewing lice spend their entire lives on animal hosts like sheep, goat, horses, cattle and antelopes. Man comes in between when caring for these animals

Order Hemiptera

'Hemi' means half and 'ptera' means wing. Some groups of this order are winged and some others non-winged. They are sometimes called the true bugs. Examples: - Bedbug, assassin bug (killer bug), kissing bug.

The true bugs vary in length up to 100mm, compound eyes are usually large, antennae are from four to five segmented and often longer than the head. Mouthparts are piercing sucking with the segmented beak arising from the anterior of the head, tarsi are one-three segmented, and cerci are absent. In most species, wings are present and positioned flat over the abdomen when at rest, separated by an enlarged scutellum; the front pair of wings is usually thickened at the base and membranous apically to form a hemelytron. The hind wings are membranous and slightly shorter than the hemelytra.

Some species of assassin bugs are naturally infected with Chagas' disease; most of these bugs belonging to the genus Triatoma. The infection may be transmitted to humans by rubbing the protozoan organism in Triatoma feces through the skin by scratching