

➤ **Family: Carabidae (Ground beetles)**

1. Adults are often black in colour and some brightly spotted.
2. Some cannot fly because they have fused elytra and atrophied hindwings.
3. Legs are suited for running.
4. They are nocturnal. Ground beetles are voracious predators both as adults and larvae.
5. They feed on soft bodied caterpillars and other insects.



➤ **Family: Dytiscidae (True water beetles, diving beetles)**

1. Body is long, oval, smooth and shiny.
2. Head, thorax and abdomen are compactly joined.
3. Antenna is filiform.
4. In some male beetles the fore tarsi are provided with cup like suckers which are useful in clasping the mate.
5. Hindlegs are flattened, fringed with hairs and suited for swimming.
6. Air is stored beneath the elytra.
7. Adults and larvae are aquatic predators



II) Suborder: Polyphaga

➤ **Family: Bruchidae (Seed beetles)**

1. They are small, short beetles.
2. Head is small and the snout is blunt.
3. Antenna is serrate.
4. Hind femur is thick.
5. Elytra are short and do not cover the abdomen fully



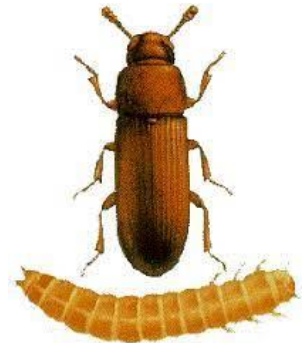
➤ **Family: Curculionidae (Weevils, snout beetles)**

1. Minute to large sized insects.
2. Frons and vertex of the head are produced into snout.
3. Mouthparts (Mandibles and maxillae) are present at the tip of the snout. It is useful to feed on internal tissues of the plant and provide a place for egg laying.
4. Antenna is geniculate and found usually in the middle of the snout.
5. Grubs are apodous and eucephalous.
6. Weevils are important crop pests occurring both in field and storage.



➤ **Family: Tenebrionidae (Meal worms)**

1. Body is flat and elongate.
2. Elytra is often sculptured.
3. Legs are heteromerous with a tarsal formula of 5-5-4.
4. Larvae are called meal worms.
5. Red flour beetle: *Tribolium castaneum*. It is an important pest of milled products.



➤ **Family: Coccinellidae (Lady bird beetles)**

1. They are hemispherical. The body is convex above and flat below.
2. Their body appearance resembles a split pea.
3. Head is small, turned downward and received into a prominent notch of prothorax.
4. Elytra is strongly convex, brightly coloured and variously spotted.
5. Grubs are compodeiform and spiny.
6. The last larval skin either cover the pupa or gets attached to the anal end of the pupa.



➤ **Family: Scarabaeidae (Scarabs, Dung beetles)**

1. Head is broad and flat.
2. Mandibles are membranous and incapable of chewing.
3. Many have spines and horns on head and prothorax.
4. Forelegs are fossorial in some species.
5. Middle legs are widely separated
6. Adults and larvae are scavengers.



Order Diptera (Flies)

1. They are small to medium sized, soft bodied insects.
2. The body regions are distinct.
3. Head is often hemispherical and attached to the thorax by a slender neck.
4. Mouthparts are of sponging type, but may be modified.
5. All thoracic segments are fused together. The thoracic mass is largely made up of mesothorax. A small lobe of the mesonotum (scutellum) overhangs the base of the abdomen.
6. They have a single pair of wings.
7. Forewings are larger, membranous and used for flight.
8. Hindwings are highly reduced, knobbed at the end and are called halteres. They are rapidly vibrated during flight. They function as organs of equilibrium. Flies are the swiftest among all insects.
9. Metamorphosis is complete. Larvae of more common forms are known as maggots. They are apodous and acephalous. Mouthparts are represented as mouth hooks which are attached to internal sclerites. Pupa is generally with free appendages, often enclosed in the hardened last larval skin called puparium. Pupa belongs to the coarctate type.

❖ I) Suborder: Nematocera (Thread-horn)

1. Antenna is long and many segmented in adult.
2. Larval head is well developed.
3. Larval mandibles act horizontally.
4. Pupa is weakly obtect.
5. Adult emergence is through a straight split in the thoracic region.
6. Nematocera includes families: Culicidae (Mosquitoes), Tipulidae (crane flies) and other families.

❖ II) Suborder: Brachycera (Short-horn)

1. Antenna is short and few segmented in adult.
2. Larval head is retractile into the thorax
3. Larval mandibles act vertically
4. Pupa is exarate.
5. Adult emergence is through a straight split in the thoracic region.
6. Brachycera includes families: Tabanidae (Horse flies), Syrphidae (Hover flies, Flower flies), Muscidae (House fly), Calliphoridae (Metallic fly or Blow fly) and other families.

I) Suborder: Nematocera (Thread-horn)

➤ Family: Culicidae (Mosquitoes)

1. They are delicate, fragile, slender insects
2. Females have piercing and sucking type of mouthparts with six stylets.
3. Antenna is plumose (bushy) in male and pilose (less hairy) in female.
4. Legs are slender, delicate and long.
5. Wings are fringed with hairs and scales on hind margin and on some veins.
6. Males are short lived and feed on nectar or decaying fruits.
7. Females live long and are blood feeders.



➤ Family: Tipulidae (crane flies)

1. Long slender legs
2. "V"-shaped suture transects dorsal side of thorax
3. Conspicuous halteres



➤ **II) Suborder: Brachycera (Short-horn)**

➤ **Family: TABANIDAE (Horse flies)**

1. Body is stout
2. Head is large. Eyes are large and often brilliantly coloured. In male eyes are holoptic (contiguous) and in female dichoptic (seperate). The third antennal segment is annulated. The proboscis is strong and pointing downwards.
3. They are swift fliers.
4. Male feeds on nectar. Female sucks blood from cattle and horses. They spread anthrax.



➤ **Family: Syrphidae (Hover Flies, Flower Flies)**

1. They are brightly coloured and brilliantly striped. A vein like thickening (spurious vein) is present in between the radius and median in the forewing.
2. Abdomen has distinct black and yellow markings.
3. Maggots prey on soft bodied insects especially aphids.
4. Adults are excellent flies. They hover over flowers. They feed on pollen and nectar. They aid in pollination.



➤ **Family: MUSCIDAE (House fly)**

1. Aristate antenna, antennal arista is plumose.
2. Mouthparts are sponging type. Labium is distally modified into a pair of oval shaped fleshy lobes called labella.
3. Pretarsus consists of two claws and two adhesive pads.
4. First abdominal segment is yellow in colour. Terminal abdominal segments are telescopic forming a pseudo ovipositor.
5. Maggots are scavengers. Adults carry certain disease causing microbes on its legs, body hairs and mouthparts

