

4. **Retinaculum** (Fig. 23C, D): It is a strong curved process (in males) or a group of strong hair (in females) on the lower side of the fore wing. The frenulum is held by the retinaculum, e.g., geometrid moths.

5. **Hamuli** (Fig. 23E): These consist of a row of minute hooks on the anterior border of the hind wing that catch into the uprolled hind border of the fore wing, e.g., honeybees.

B. Legs: These are paired, jointed, primarily locomotary appendages which are articulated on the ventral side of the thorax.

The adult insects normally have three pairs of legs. The first pair is on the prothorax, the second on the mesothorax and the third on the metathorax. Now pull out the metaleg of an ak grasshopper (Fig. 24B), which is considered to be a typical or generalised leg, and study its parts.

(a) **Parts of leg:** A typical leg consists of the following parts:

1. **Coxa:** It is the first or basal segment which is large, elongated and more or less triangular in shape. It is attached with the body by a membrane, the coxal corium.

2. **Trochanter:** It is a small, triangular segment which is rigidly fixed to the femur.

3. **Femur:** It is a very long and thick segment which is provided with fishbone-shaped leaping muscles. It has a ventral groove, the femsulcus to accommodate tibia in it. The femsulcus contains a small tubercle, the Brunner's organ on its inner margin near the proximal end. The femur narrows toward its apex which is expanded to form the lateral genicular lobes. These are separated by a deep groove which allows free movement of tibia.

4. **Tibia:** It is very long and slender segment armed with two rows of spines on its dorsal surface. Its apex contains an outer and an inner pair of strong, curved spurs.

5. **Tarsus:** It consists of three segments. The first segment is longer than the second while the third one is the longest. The first segment bears three pairs of small pad-like structures, the plantulae, on its lower surface. The second segment contains a single pair, while the third segment has a single elongated pair of these structures. The tarsus ends in a pair of hair-like, strong, curved claws or ungues, which contain a bladder-like lobe, the arolium. between them. The claws and arolium together are called the pretarsus by some morphologists.

Also examine the tarsus of a robber fly (Fig. 24C). It also ends in two long, strong, curved claws. Below them is a pair of long and broad pads, the pulvilli (sing. pulvillus). Between the claws is a strong bristle-like structure, the empodium.

(b) **Types of legs:** The legs of insects are greatly modified for performing different functions. Some important modifications or types are as follows:

1. **Cursorial** (ambulatory or walking) (Fig. 24A): The femur is normal and not thickened, e.g., metaleg of cockroach.

2. **Saltatorial** (leaping or jumping)(Fig. 24B): The femur contains powerful muscles and is greatly thickened, e.g., metaleg of grasshopper.

3. **Raptorial** (catching or grasping)(Fig. 25A): The coxa is very long. The femur is long, thick, with double row of spines and a groove on the lower side. The tibia is shorter, spiny and fits into the groove of the femur, e.g., proleg of a mantid.

4. **Fossorial** (digging)(Fig. 25B): The parts are reduced and flattened to become strong for digging. The tibia has finger-like projections on its apex. The tarsus is also produced into three finger-like processes which are seen below those of the tibia, e.g., proleg of mole cricket.

5. **Natatorial** (swimming)(Fig. 25C): All parts are flattened and tarsus, in addition, has long hair, e.g., metaleg of giant water bug and water beetle.

6. **Clinging** (Fig. 25D): The tibia has a small process at its apex. The tarsus is 1-segmented and bears a claw that fits against the tibial process for clinging to the hair of the host, e.g., louse..

7. **Silk secreting** (Fig. 25E): The first segment of the fore tarsus is greatly swollen and contains silk glands, e.g., proleg of female webspinner.

8. **Antenna cleaner** (Fig. 24D): There is a large spur on the apex of the tibia which fits into a semicircular notch on the proximal end of the tarsus. This notch also contains fine hair. The antennae are drawn through this structure so that the pollens, etc., clinging to them are removed, e.g., proleg of worker honeybee.

9. **Pollen collecting** (Fig. 24E): This type has a polliniferous apparatus. The tibia is greatly dilated. Its outer surface is smooth, bordered on each side with a fringe of long curved hair, which is called corbicula or pollen basket. (On the distal end of tibia is a row of hair, the pecten or pollen rake. The basitarsus (first or basal segment of tarsus) on its base has a small ear-like lobe that contains a row of small hair. This lobe is called auricle) The basitarsus is greatly enlarged. It bears on its inner surface several transverse rows of short stiff hair which form scopa, pollen comb or pollen brush, e.g., metaleg of worker honeybee.

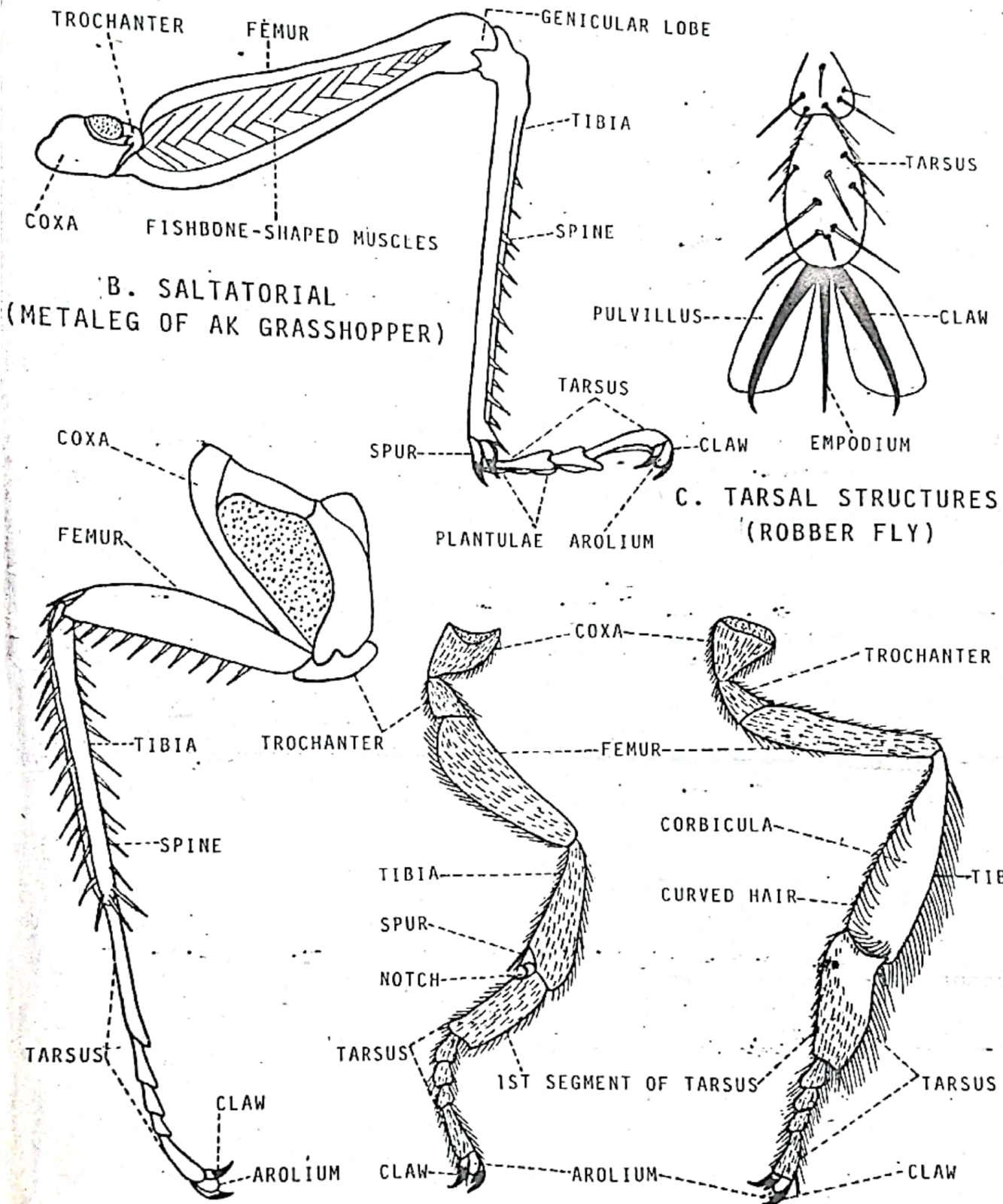
10. **Basket-like**: There is no morphological modification in this type of leg. But during flight, all legs come together to form a basket below the mouth for catching and eating insects. Note, the trochanter is 2-segmented, e.g., dragonfly and damselfly.

✓ APPENDAGES OF ABDOMEN

The most common appendages are styli, cerci and ovipositor in the adult insects and abdominal prolegs and gills in the young insects.

1. **Styli** (Fig. 8A): These are paired, short, slender, unsegmented, finger-like appendages which arise from the lower side of the abdominal segments, e.g., bristletails, doubletails, cockroaches and mantids.

2. **Cerci** (Figs. 4, 17A): They are a pair of short to very long, segmented or unsegmented, needle-like appendages which arise from the side of 11th abdominal segment, e.g., grasshoppers, crickets, cockroaches, mantids, bristletails,



A. CURSORIAL (METALEG OF COCKROACH) D. ANTENNA CLEANER (PROLEG OF HONEYBEE) E. POLLEN COLLECTING (METALEG OF HONEYBEE)

FIG. 24. STRUCTURE AND TYPES OF LEGS

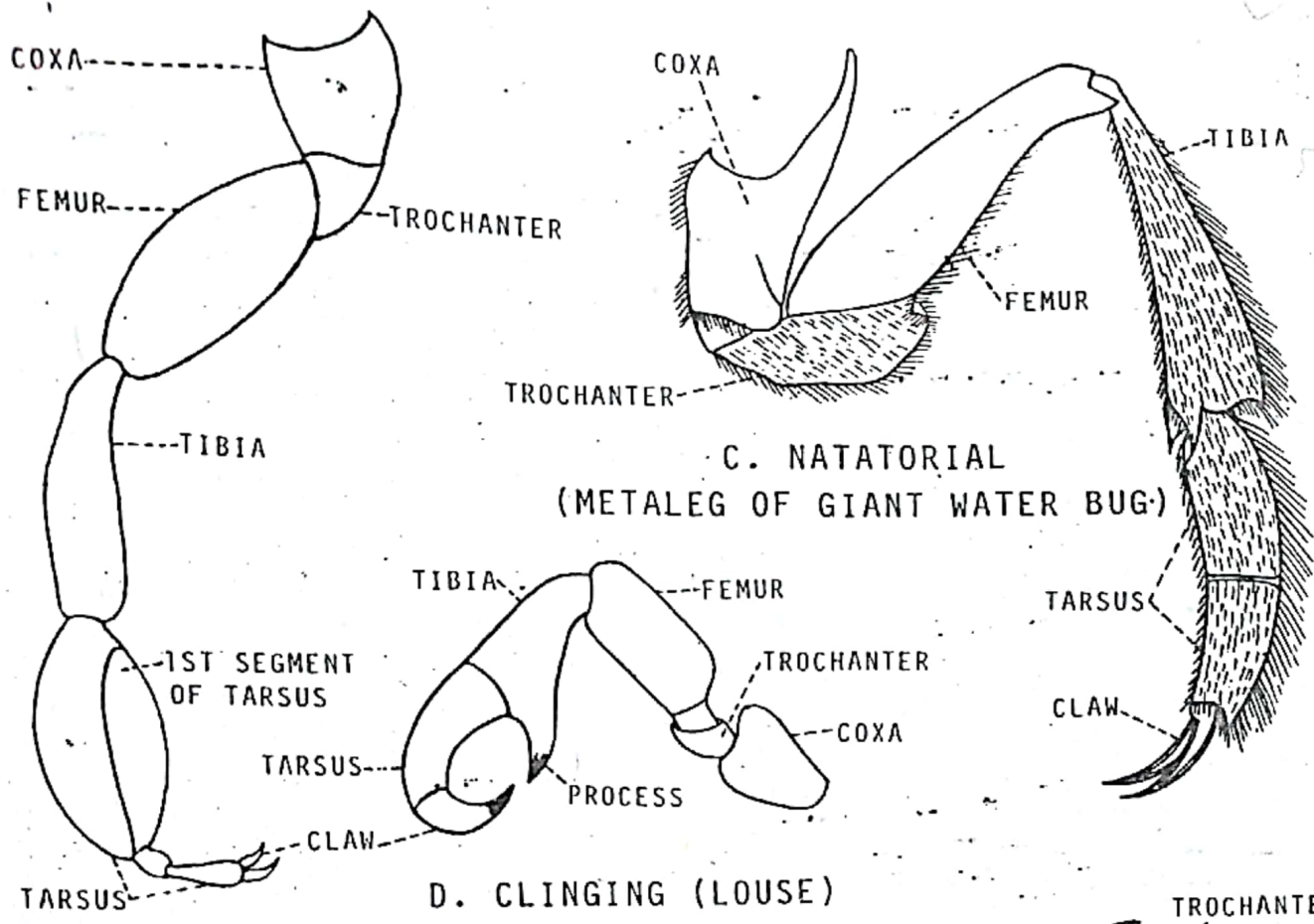
mayflies, stoneflies, etc. They may be in the form of forceps such as earwigs.

3. **Ovipositor (Fig. 4):** It is the egg-laying apparatus or external genitalia of the female that is present at the end of abdomen. It may be short (having different shapes) to very long and needle-like, e.g., grasshoppers, crickets, leafhoppers, planthoppers, etc.

4. **Abdominal prolegs (9A):** These are paired, fleshy, more or less conical, leg-like appendages present on the lower side of the abdomen of larvae, e.g., butterflies, moths, sawflies, scorpionflies, etc.

5. **Gills (Fig. 9C):** These are paired, thin-walled, respiratory appendages of the young ones of many aquatic insects. They are more frequently present on the abdomen and may have a lateral, dorsal or ventral position. They may be of different shapes such as plate-like, leaf-like, finger-like or spine-like, e.g., mayflies, stoneflies dragonflies, damselflies, caddisflies, some beetles, etc.

Some less common appendages are the median caudal filament (bristletails and mayflies), a pair of cornicles on the upper side of 5th abdominal segment (aphids), urogomphi at the end of abdomen (some beetles), ventral tube, retinaculum and furcula (springtails), etc.



E. SILK SECRETING (PROLEG OF WEBSPINNER)

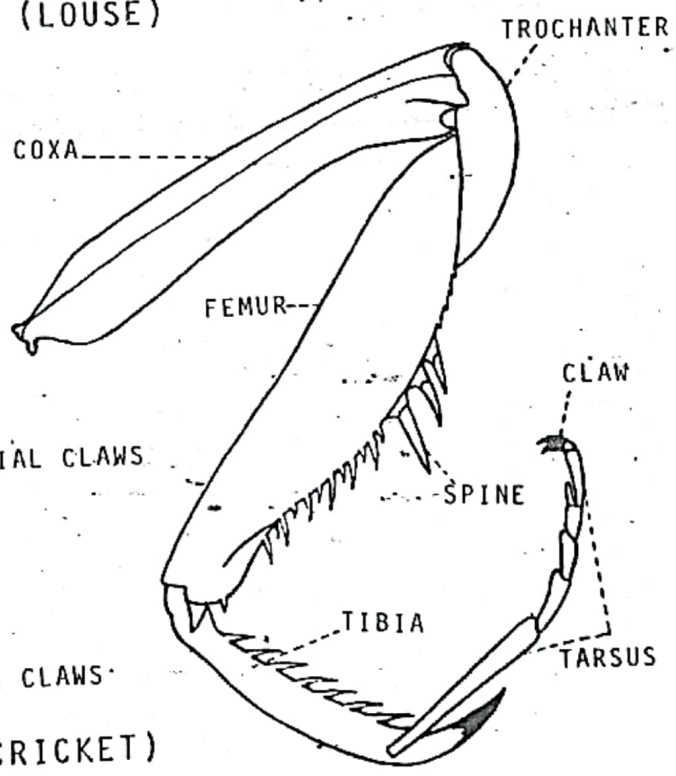
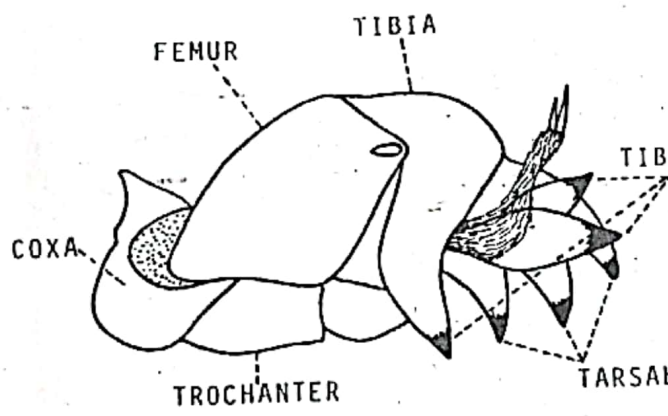


FIG. 25. TYPES OF LEGS