

INSECT APPENDAGES

These are the outgrowths of the body wall which are movable and connected with it by a membrane. The appendages of head, thorax and abdomen in different insects are given below.

APPENDAGES OF HEAD

These comprise the antennae and mouthparts. It may be noted that according to the definition of appendages, the eyes are excluded from them.

A. **Antennae:** They are a pair of jointed, primarily sensory appendages which are located between or below the compound eyes on the head. They are also called feelers. They are absent in the insects of the order Protura.

(a) **Parts of antenna:** Each antenna consists of three parts, viz., scape, pedicel and flagellum (Fig. 18B). The scape is the first or basal segment of the antenna. It is usually longer and thicker than the following segment. The pedicel is the second segment which is generally small. All the remaining segments are usually similar and together called the flagellum. The latter is further divided into ring segments (very small and ring-like), funicle (ordinary segments) and club (swollen segments as in Fig. 18K) in most of the chalcids (parasitic wasps). As the shape of flagellum varies greatly in different insects, there are many types or modifications of antennae. It must be remembered that while describing different types of antennae, you have to consider only the shape of the flagellar segments.

(b) **Types of antennae:** The important types of antennae are as follows:

1. **Setaceous** (bristle-like)(18A): The segments of flagellum gradually taper or narrow towards apex like a hair, e.g., dragonflies, damselflies, stoneflies, silverfish and cockroaches.

2. **Filiform** (thread-like)(18B): The segments of flagellum are almost cylindrical and of the same thickness like a thread, e.g., ak grasshopper, locust, red cotton bug, earwigs, psocids and shield bugs.

3. **Moniliform** (bead-like)(Fig. 18C): The segments of flagellum are more or less globular like a bead, e.g., termites, doubletails, beaded lacewings and wrinkled bark beetles.

4. **Serrate or dentate** (saw-like or tooth-like)(Fig. 18D): The segments of flagellum have short triangular or tooth-like projections on one side, e.g., pulse beetles (dhora) and most click beetles.

5. **Pectinate** (comb-like)(Fig. 18E): The segments of flagellum have long, slender and stiff projections on one side like the teeth of a comb, e.g., cardinal beetle. When these projections are on both sides, the antenna is called bipectinate, e.g., silkworm moth, saturniid moths, some noctuid moths and sphingid moths.

6. **Plumose** (feather-like or densely hairy)(Fig. 18F): The segments of

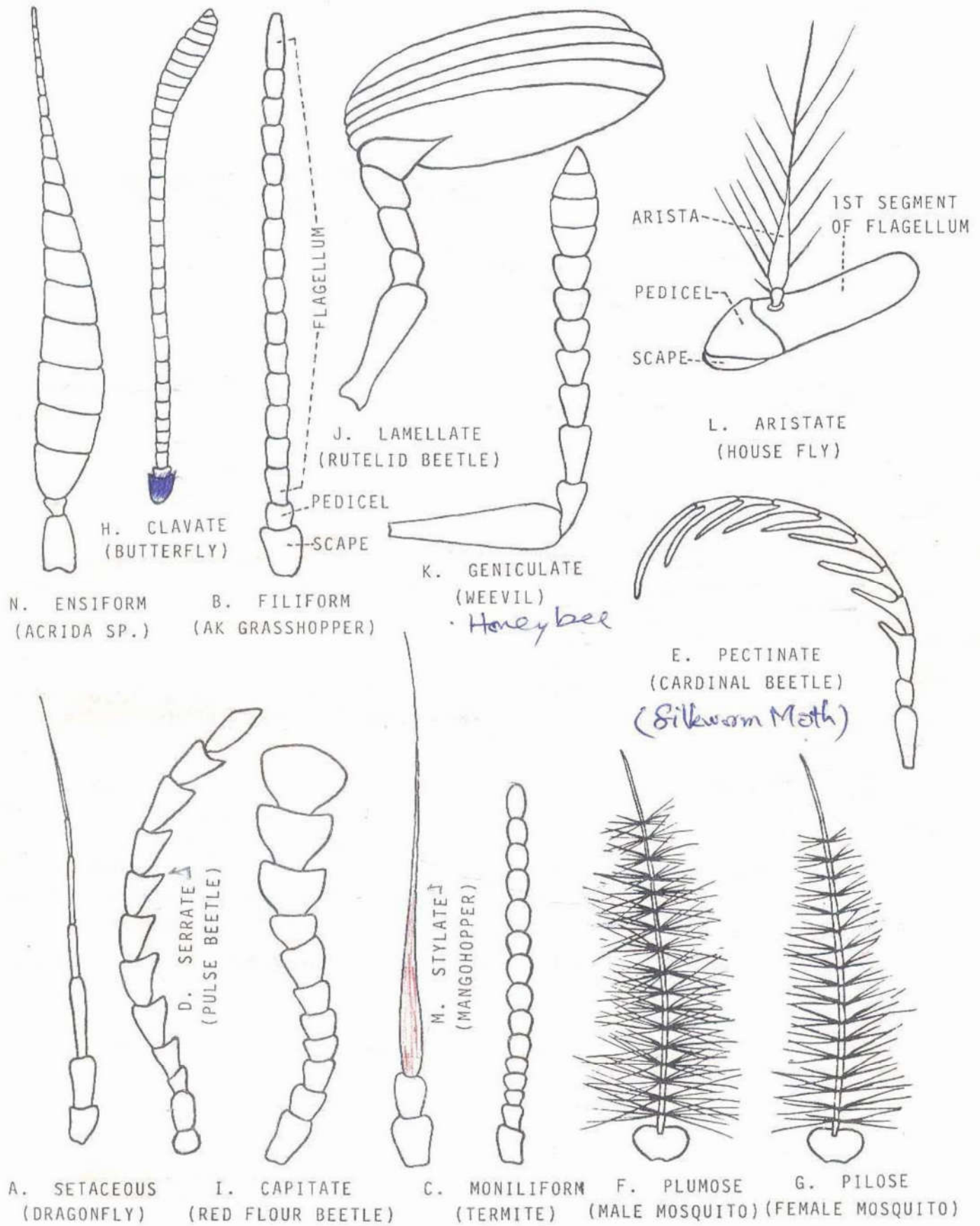


FIG. 18. ANTENNAE OF INSECTS

flagellum (except the distal ones) have thick whorls of long hair on them, e.g., male mosquitoes.

7. Pilose (sparsely hairy)(Fig. 18G): The segments of flagellum (except the distal ones) have very thin whorls of short hair on them, e.g., female mosquitoes.

8. Clavate (club-shaped)(Fig. 18H): The segments of flagellum gradually broaden towards apex, e.g., butterflies, antlions, trogossitid beetles and some darkling beetles.

9. Capitate (knob-like or head-like)(Fig. 18I): One or a few terminal segments of flagellum are suddenly thickened to form a head-like structure, e.g., red flour beetle, powderpost beetles, nitidulid beetles and amblyceran biting lice.

10. Lamellate (leaf-like)(Fig. 18J): The terminal segments of flagellum are expanded into long, broad leaf-like plates on one side, e.g., rutelid beetles, rhinoceros beetles and dungrollers.

11. Flabellate (tongue-like): It has some resemblance to the lamellate antenna. But in this type one or more segments of flagellum are produced into long, thick, tongue-like processes slightly broadening towards apices, e.g., male stylopids and sandalid beetles.

12. Geniculate (elbow-like)(Fig. 18K): In this antenna the scape is very long and forms a sharp bend with the remaining segments like a flexed arm, e.g., weevils, honeybees, chalcid wasps and stag beetles.

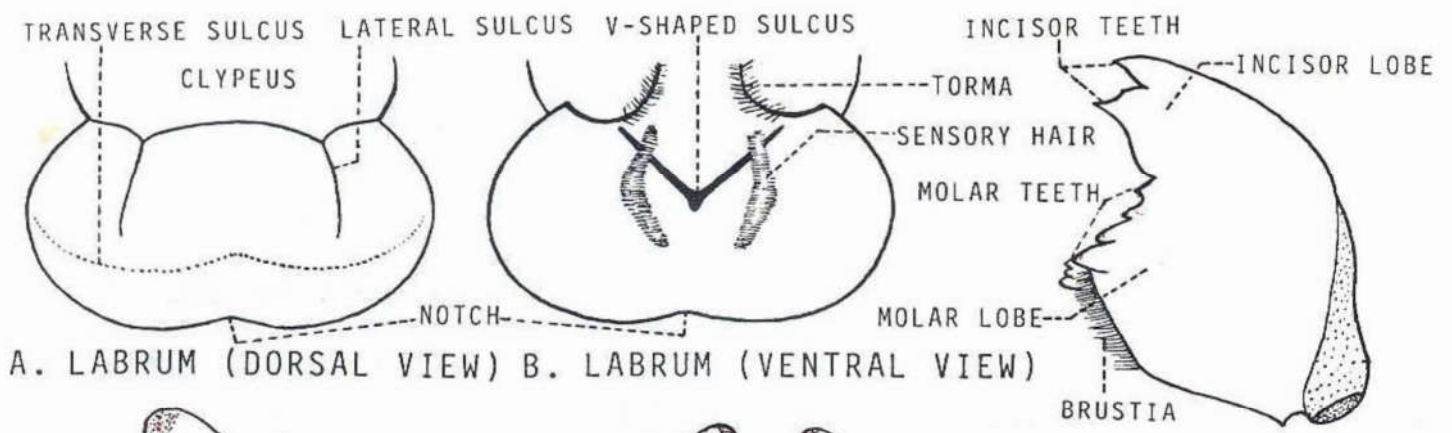
13. Aristate (arista-like)(Fig. 18L): The scape is very small while the pedicel is large and triangular. The first segment of flagellum is greatly enlarged, where as the remaining segments are modified into a large hairy bristle, the arista, which is attached to the first segment on the dorsum of its base, e.g., house flies, fruit flies, syrphid flies, etc.

14. Stylate (styliform or setiform)(Fig. 18M): The flagellum forms a long, unsegmented, terminal hair, e.g., mango hoppers (leafhoppers), planthoppers, cicadas, robber flies, delphacid bugs and mayflies.

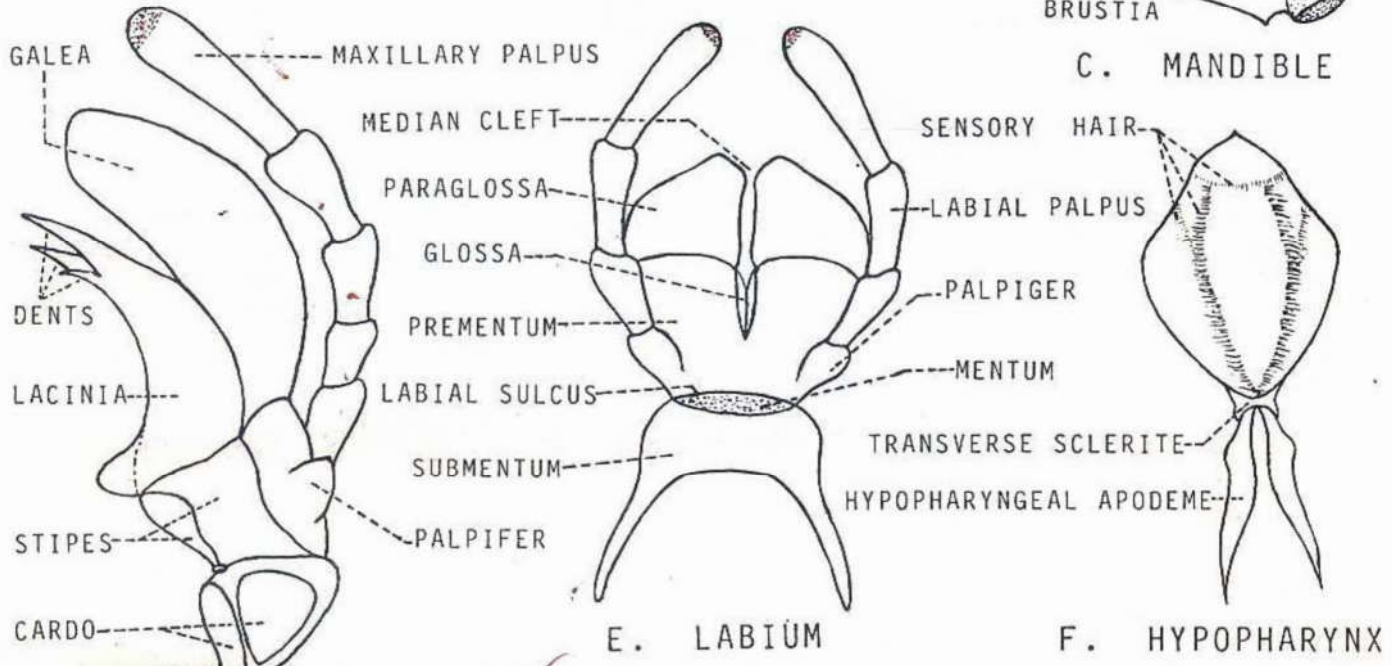
15. Ensiform (sword-like)(Fig. 18N): The segments of flagellum are thin, flattened and gradually taper towards apex like a leaf-blade or a sword, e.g., green grasshoppers (*Acrida sp.*).

B. Mouthparts: These are the organs of feeding which typically consist of the following five parts:

1. Labrum (upper lip)
2. A pair of mandibles (upper jaws)
3. A pair of maxillae (lower jaws)
4. Labium (lower lip)
5. Hypopharynx (tongue or lingua)

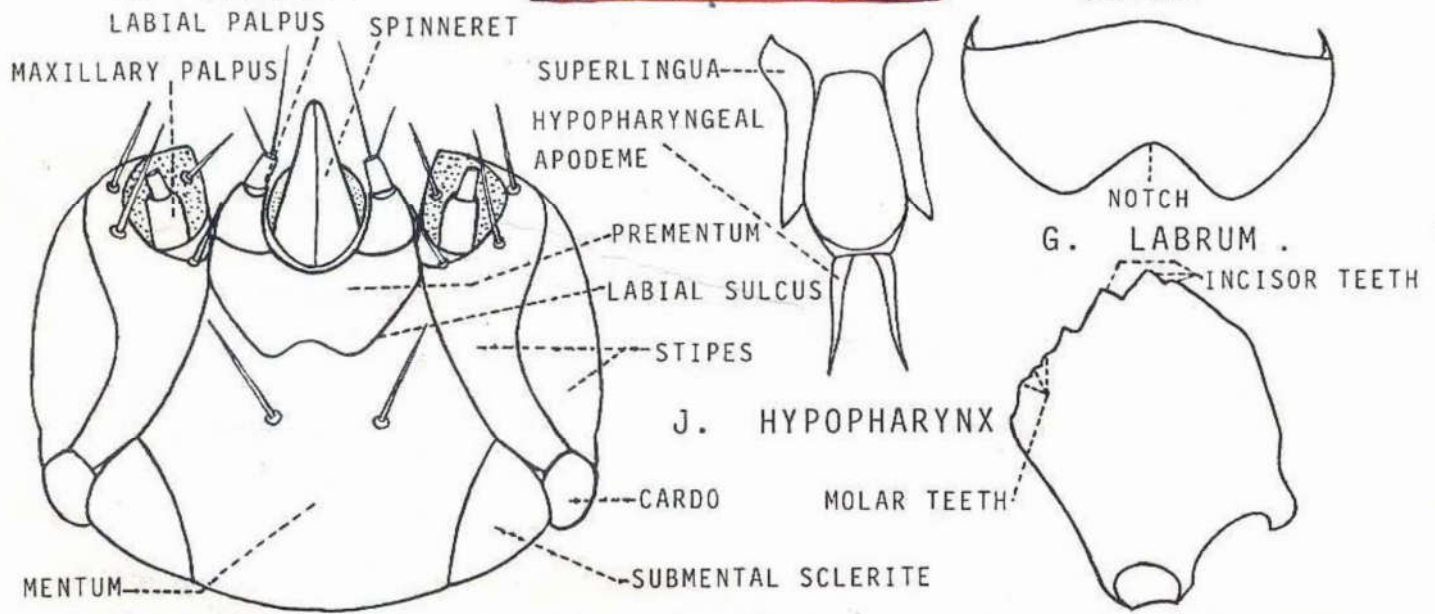


A. LABRUM (DORSAL VIEW) B. LABRUM (VENTRAL VIEW)



D. MAXILLA

AK GRASSHOPPER



I. MAXILLAE AND LABIUM

SILKWORM LARVA

H. MANDIBLE

FIG.19. CHEWING TYPE OF MOUTHPARTS

These parts are greatly modified in different insects due to their different methods of feeding. Hence, there are many types or modifications of mouthparts. They are generally classified into chewing (mandibulate) and sucking (haustellate) types. Insects with chewing mouthparts cut and chew or masticate the food with hard mandibles. But those with sucking mouthparts have a somewhat elongated beak or proboscis to suck the liquid food. They have further many types. The mouthparts are often classified as ectognathous and entognathous. In the former case, the mouthparts are not hidden within the head, e.g., bristletails, grasshoppers, bugs, butterflies, etc. In the latter case, the mouthparts are hidden within the head such as doubletails, telsonails and springtails.

I. Chewing or biting type: Under this type, you will dissect out the mouthparts of the following two insects and compare them.

1. **Ak grasshopper** (*Poekilocerus pictus*): Dissect out the mouthparts in the following order and place them on a slide.

Labrum (Fig. 19A, B): It is a broad flap-like sclerite attached to the clypeus and capable of up and down movement. It forms the roof of the mouth cavity. Its anterior border has a slight notch. Its upper surface has two short lateral sulci dividing its basal half into three parts. It has also an ill-defined transverse sulcus which divides it into an anterior and a posterior part. Its lower surface is lined with a membrane, the epipharynx. There is a V-shaped sulcus in its posterior part. It has also two median curved bands of sensory hair. The posterior angles of labrum have two sickle-shaped sclerotised bars, the tormae.

Mandibles (Fig. 19C): These are paired, triangular, asymmetrical, strongly sclerotised but hollow jaws lying below the labrum. They move sideways. The biting surface of each mandible has two lobes, namely, the molar lobe and the incisor lobe. The former is near the base of the mandible and has a group of short and blunt molar teeth (dents) which form the mola or grinding area. The latter has a group of longer and acute incisor teeth (dents) which cut the food. The inner edge between the molar teeth and the base of the mandible has a row of short hair called brustia.

Maxillae (Fig. 19D): These are paired structures lying below the mandibles. They move sideways just like mandibles. Each maxilla consists of a basal sclerite, the cardo (pl. cardines) which on its apex has an other sclerite, the stipes (pl. stipites). The cardo has further two parts, an outer broad and triangular and an inner long and narrow one. Similarly the stipes has also two parts, an outer broad and rectangular and an inner long and narrow one. The stipes contains three structures on it. On its outer side is a small process called palpifer which bears on it an antenna-like 5-segmented structure, the maxillary palpus (pl. palpi). The stipes on its apex bears two lobe-like structures. The outer one is broad, elongate and called the galea while the inner one is basally broad but tapering anteriorly and known as the lacinia. The latter is strongly sclerotised and has three black pointed dents at its apex.

Note: When the two lobes on the stipes fuse and form a single structure, it is called mala.

Labium (Fig. 19E): It is a single structure lying below the maxillae. It closes the mouth from the lower side. It is divided by an ill-defined transverse labial sulcus into two main parts: the posterior one, the postmentum and the anterior one, the prementum. The postmentum is further divided into two parts: the lower very large is the submentum while the upper very small (in the

form of a narrow transverse belt) is the mentum. The prementum contains three pairs of structures on it. It bears at its apex two large triangular lobes, the paraglossae which are separated by a deep median cleft. At the base of this cleft are two small and narrow lobes, the glossae. The prementum, on either side of its base, has a small process which is fused with it and called palpiger. Each palpiger bears on it an antenna-like 3-segmented structure, the labial palpus.

Note: When the four lobes of the prementum are fused and form a single structure, it is called ligula.

Hypopharynx (Fig. 19F): When the labrum and mandibles are removed, a large median fleshy lobe, the hypopharynx is seen in the mouth cavity. It is attached to the base of the labium. The hypopharynx is broad from the middle and tapers anteriorly as well as posteriorly. Its anterior end looks like a triangular lobe. Its dorsal side bears two slightly curved longitudinal rows of sensory hair which after branching near their anterior ends merge into a transverse row. The hypopharynx has also a posterior transverse sclerite from which come out two hypopharyngeal apodemes or processes for the attachment of muscles.

2. Silkworm Larva (*Bombyx mori*): Dissect out the mouthparts and mount them on a slide in a drop of glycerine. Note that the larvae of butterflies and moths have the chewing type whereas their adults have the siphoning type of mouthparts. The latter will be described at the end of the mouthparts.

Labrum (Fig. 19G): It is a small sclerite which has a deep notch in the anterior border. Its base is attached to a narrow and transversely elongated clypeus. The epipharynx is not differentiated on its lower surface.

Mandibles (Fig. 19H): These are small, paired and strongly sclerotised structures lying below the labrum. The biting surface of each mandible has both the incisor and molar teeth. The former are pointed and the latter are blunt.

Maxillae (Fig. 19I): These are paired structures lying below the mandibles. They are fused with the labium on its sides. Take out the entire lobe consisting of labium and maxillae with the help of your dissecting needle. Each maxilla consists of a small basal sclerite, the cardo. It has on it a large, characteristic, longitudinally divided sclerite, the stipes which contains 2-segmented maxillary palpus on a palpifer. The galea and lacinia are fused and not differentiated.

Labium (Fig. 19I): It is present between the maxillae and closes the mouth from the lower side. It consists of three main parts, viz., submentum, mentum and prementum. The submentum comprises a pair of widely separated triangular submental sclerites present at the base of the maxillae. The mentum is very large and present between two stipites. It is separated from the prementum by a W-shaped labial sulcus. The prementum is large and carries a median process, the spinneret on its distal side. It is formed from the fusion of glossae and paraglossae. On the sides of the spinneret are two very small labial palpi, each consisting of 2 segments.

Hypopharynx (Fig. 19J): After removing the labrum and mandibles, the hypopharynx becomes visible. It is a median pad-like lobe which is attached to the base of the labium in the mouth cavity. There are two lobes on its