

These are the organs primarily concerned with the uptake of food. Typical mouthpart of an insect consists of the following parts.

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

**Insect mouthparts divided into two groups:-**

**1-Mandibulate (chewing) mouthparts** are used for biting and grinding solid foods. Examples: Dragonflies and damselflies (order Odonata), termites (order Isoptera), adult lacewings (order Neuroptera), beetles (order Coleoptera), ants (order Hymenoptera), cockroaches (order Blattaria), grasshoppers, crickets and katydids (order Orthoptera), caterpillars (order Lepidoptera). Adult Lepidoptera have siphoning mouthparts.

**2-Haustellate or Suctorial mouthparts** are primarily used for sucking liquids and can be broken down into two subgroups:

**a-peircing-sucking mouthparts**

**b-nonpeircing-sucking mouthparts**

The mouth parts of insects can be basically grouped in to following types based on the type of food and method of feeding.

**Typical chewing type of Mouth Parts:**

This type is considered as primitive and found in Orthoptera, Isoptera and Coleoptera, larvae of Lepidoptera and Neuroptera etc. The mouth parts include following parts (Fig. 1)

**Labrum.** The labrum is a simple fused sclerite, often called the upper lip, and moves longitudinally. It is hinged to the clypeus. Helps to pull food into the mouth. The inner surface of labrum is the epipharynx. Epipharynx bears mechano- and chemosensilla.

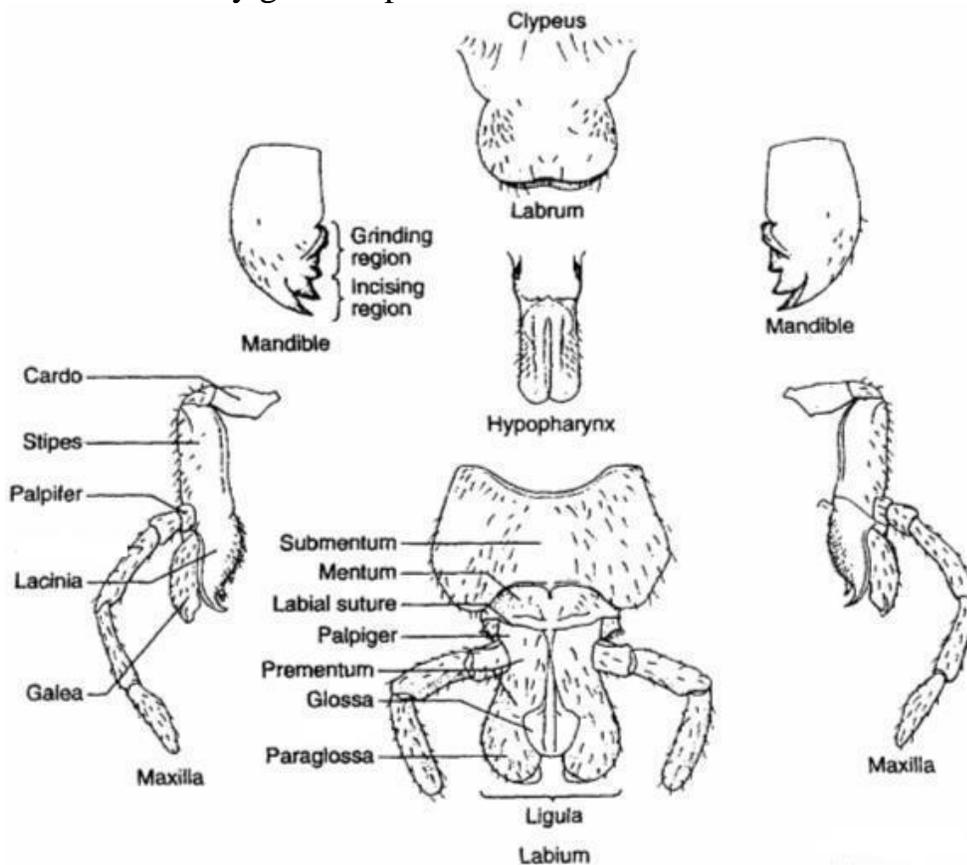
**Mandibles.** The mandibles, one on each side, are hinged to the head capsule by one or two condyles. Used to chew, cut, and tear food, to carry things, to fight, and to mold wax. The mandibles are opened and closed by a pair of muscles; one inserted on either side of the axis of mandibular attachment at the condyles. The opener muscle is called the **abductor**, whereas the closer is the **adductor**.

**Maxillae.** These are paired homologous structures with basal triangular cardo, middle rectangular 'stipes' and the lateral 'palpifer' bearing maxillary palpi and lobe like inner

‘lacinia’ and outer ‘galea’. Maxillary palps possess olfactory and gustatory sense receptors and function as sensory organs. These Galea and lacinia helps in holding the food material along with the mandibles.

**Labium.**It is known as lower lip and is also called as second maxillae. It closes the mouth cavity from below. It is divided in to proximal prementum central mentum and distal submentum, near the base of the prementum is the palpiger which carry the labial palps which are antenna-like pieces consisting of 1 to 4 segments and functioning as sensory organs. Prementum has four terminal lobes. The median pair is ‘glossae’ and outer ‘paraglossae’ together called.

**Hypopharynx.** It is a tongue like structure situated between labrum and labium and ducts of salivary glands open on or near its base.



**Fig.1 Biting and chewing type of mouthparts.**

**Mouthparts modification.**

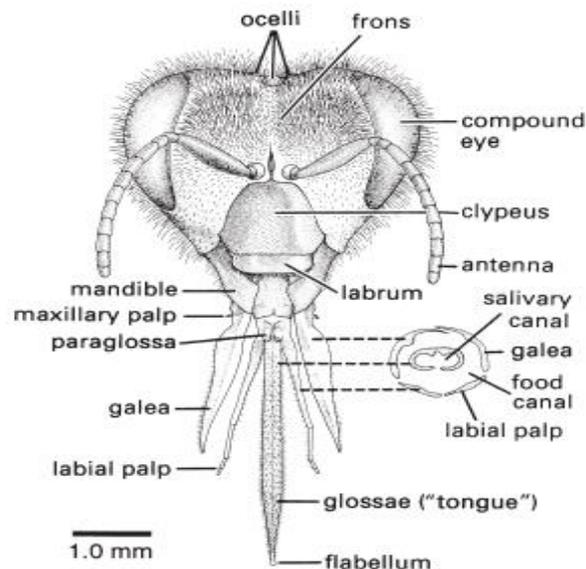
- 1.Chewing and lapping type ex. Honey bees
- 2.Sucking or siphoning type ex. butter fly
- 3.Piercing and sucking type Plant ex. Bugs and Mosquitoes
- 4.Rasping and sucking type ex.Thrips
- 5.Sponging type ex.Adult Houseflies
- 6.Cutting-lapping type ex. horse fly

7. Cutting-sucking type ex. stable fly

**Modification in predaceous insect mouthparts.**

1. predaceous with sucking type (larva of ant lion)
2. predaceous with biting (Naiads of Dragonflies)

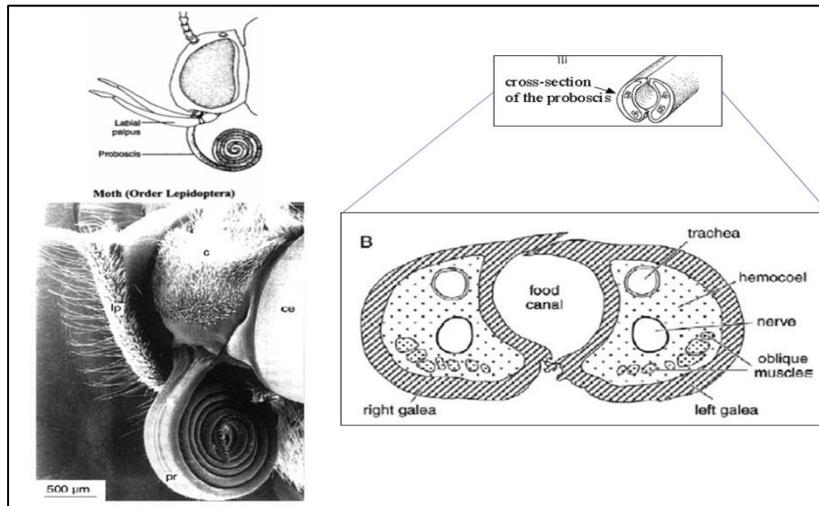
**Chewing and lapping type of Mouthparts.** The mouthparts of bees are of a chewing and lapping type. Lapping is a mode of feeding in which liquid or semi-liquid food adhering to “tongue”, is transferred from substrate to mouth. In the honey bee, *Apis mellifera*, the elongate and fused labial glossae form a hairy tongue, which is surrounded by the maxillary galeae and the labial palps to form a tubular proboscis containing a food canal (Fig. 2). In feeding, the tongue is dipped into the nectar or honey, which adheres to the hairs, and then is retracted so that adhering liquid is carried into the space between the galeae and labial palps. Glossae is provided with long hairs and a small spoon shaped lobe, called flabellum at its apex. The maxillary laciniae and palps are rudimentary and the paraglossae embrace the base of the tongue, the mandibles are dumbbell shaped, non-trophic and industrial in function, have a variety of functions, including the manipulation of wax and plant resins for nest construction, the feeding of larvae and the queen, fighting, and the removal of nest debris including dead bees.



**Fig.2. Chewing and lapping type of mouthparts**

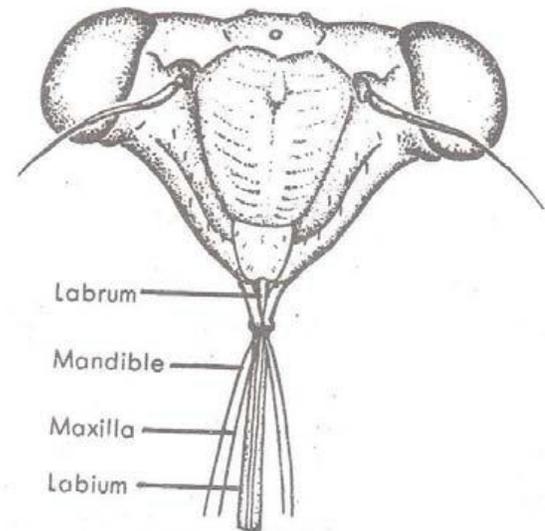
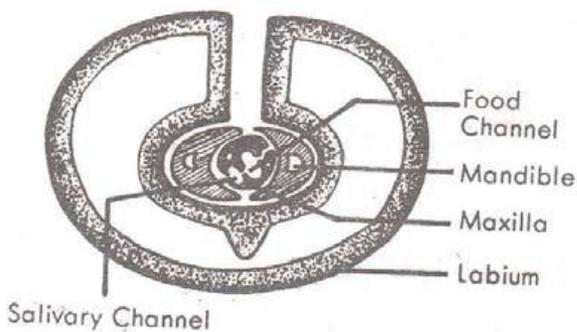
**Siphoning type of Mouth parts** eg. Butterflies. These are specially modified for taking nectar from the flowers. The galea of maxilla form into a slender, hollow, tubular structure which remains as an elongated coiled proboscis underneath the head during non-feeding (Fig. 3). Mandibles are totally absent. The labrum and maxilla palpi are

reduced. Labium is modified into a small basal plate possessing a 3 segmented labial palpi. The food channel is formed by the fusion of both the galea.



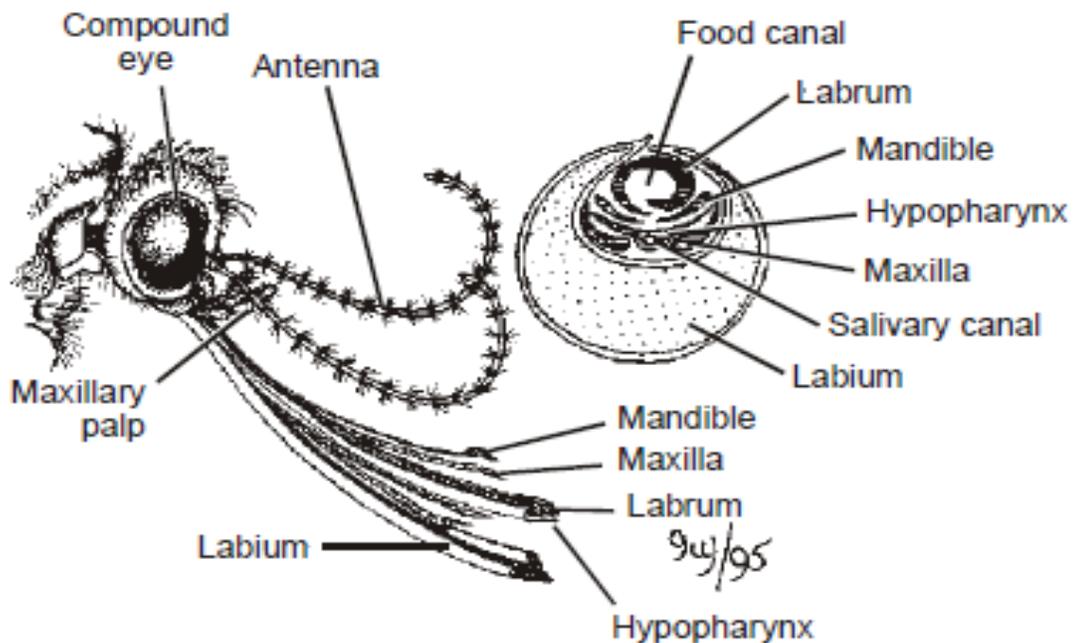
**Figure 3. Sucking type of mouth Parts.**

**Piercing and sucking type** e.g plant bugs, mosquitoes. They are mainly adopted for piercing the tissues and sucking either plant sapor the nectar or blood from the host. Mouth parts are represented by rostrum/beak which is a modification of Labium. It acts as a pouch for protecting the mandibular and maxillary stylets. Mandibles and maxillae are modified into sharp needle like stylets (Fig. 4). The mandibular stylets form the outer pair and possess serrated margins at their tip. The maxillary stylets forms the inner pair having smooth curved tips and combine together enclosing a food channel. Labrum is modified into a small flap like structure at the base of rostrum. Insects with these types of mouthparts pierce the tissues with the mandibular stylets and suck the contents (sap/ blood / nectar) through cibarium with the action of pharyngeal and cibarial muscles.



**Figure 4. Piercing and sucking mouthparts (plant bug)**

**Piercing and sucking mouthparts in Mosquitoes (female) it consist of six stylet(fig.5).**Labrum epipharynx (enclosing the food canal); Hypopharynx (containing the salivary duct).Paired mandibles (with acute apex);Paired maxillae (with toothed apex)Labium (ensheaths the peirsingstylets but do not penetrate the feeding puncture) Blood is taken into the food canal by suction (suction is provided by cibarial pump)



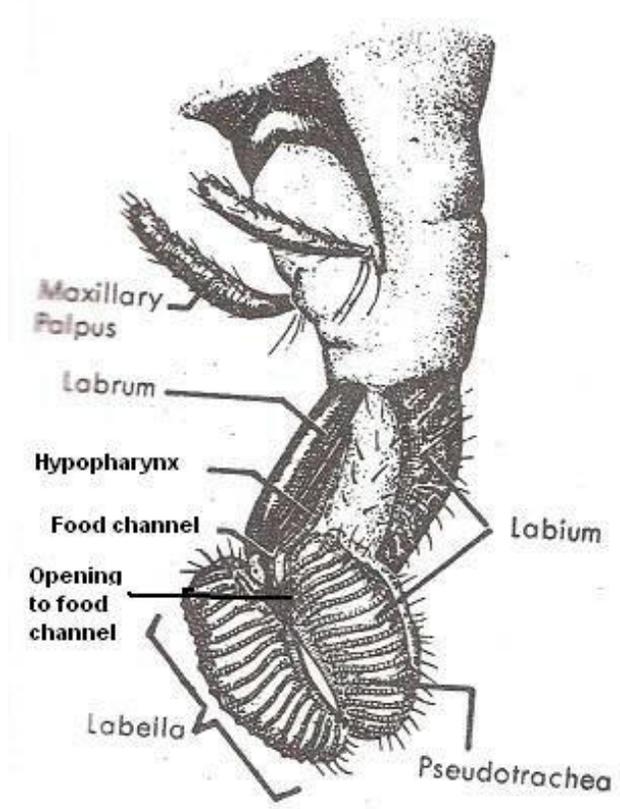
**Figure 5. Piercing and sucking mouthparts in Mosquitoes (female)**

**Sponging type of Mouth Part**seg.Housefly.These mouthparts are represented by proboscis formed from the labium.The proboscis is divided into a basal rostrum, middle haustellum and a distal labellum.The labellum is a sponge like structure. It is traversed by a number of narrow transverse channels called pseudotrachea which converge at one point in the centre of the labellum. From this point, the food enters in to food channel which is formed by the labrum- epipharynx and hypopharynx. Mandibles are absent (reduced) maxillary palpi are 1-3 segmented (Fig. 6).During feeding, the proboscis is pressed over the food material.The pseudo trachea gets filled with the food material by the capillary action.

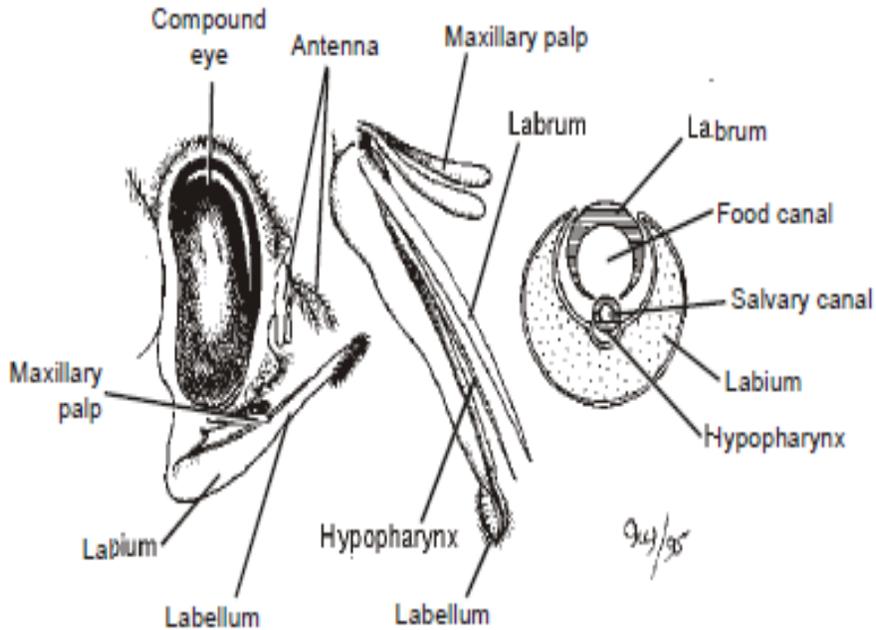
**Cutting and sucking mouthparts eg stable fly and tsetse fly.**

Is regard as asecondary modification of sponging type, the labium is the most prominent mouthpart, is selender, and stiff with the labellum reduced in size and provided at tip with rasping denticles; the mandible is missing and the palps are all that

remain of the maxillae (Figure 7).the labrum and hypopharynx are partly enclosed by the labium so that the combined appendages form the piercing organ.



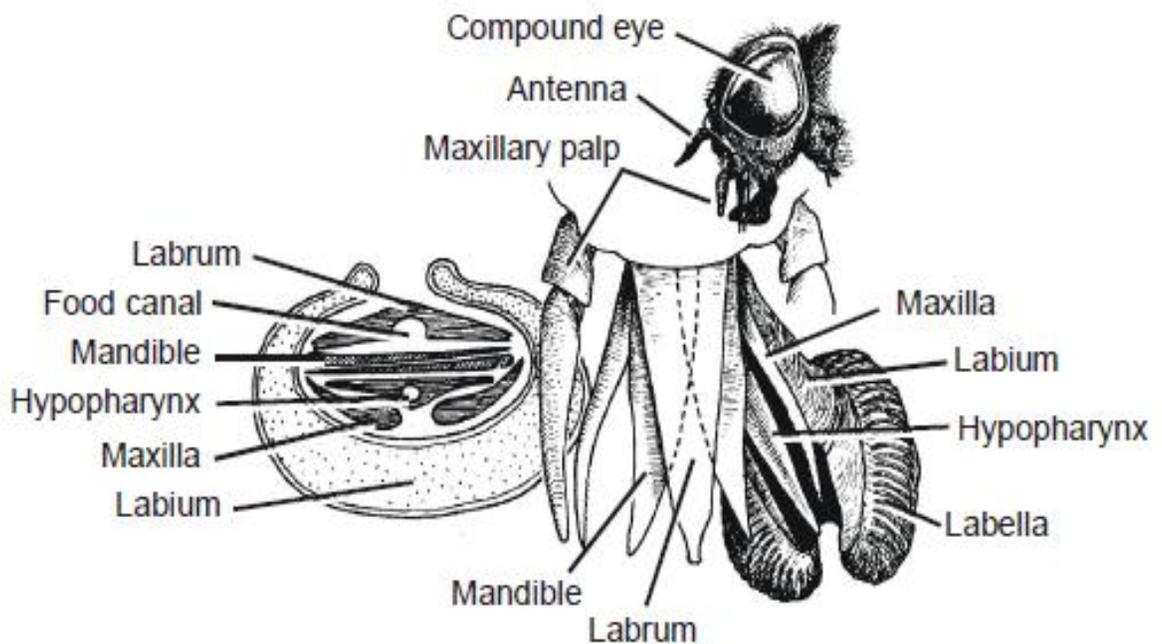
**Figure 6. Sponging type of mouthparts (house fly)**



**Figure7.Cutting and sucking mouthparts of stable fly.**

### Cutting and lapping. Horse fly

Horse flies, *Tabanus* spp., and deer flies, *Crysops* spp. All the ancestral mouthparts are present, but highly modified and divided in two main functional components (Figure 8). The cutting blades are formed from the mandibles and the laciniae of the maxilla. They open and close much like a pair of scissors as they cut through the skin. It is the combined action of the paired mandibles and maxillae that makes the bite of these two flies so painful. The hypopharynx is elongated and has a central salivary canal that releases saliva into the blood that pools in a wound. The apex of the labium is greatly enlarged in two lobes (labellum), the under surfaces of the lobes are traversed by fine grooves called pseudotrachea.



**Figure 8. Cutting and lapping mouthparts of horse fly(female).**