

LECTURE 5

ADAPTATIONS OF THE MOUTHPARTS

Insect Mouthparts: Top left, chewing, top right, sponging; center, piercing-sucking; bottom, siphoning. (F. W. Zettler, Cornell)

Types of insect mouthparts

Mouthparts of insects vary to a great extent among insects of different groups

depending upon their feeding habits. They are mainly of two types viz.,

Mandibulate

(feeding mainly on solid food) and **haustellate** (feeding mainly on liquid food).

1. **Biting and chewing type:** e.g. Cockroach & grasshopper. It is the primitive type of

mouth part and consists of the following parts.

i. **Labrum** : (Upper lip) It is flap like, bilobed and attached to the clypeus by an articular

membrane. It is movable. It covers the mouth cavity from above. It helps to pull the food

into the mouth. It holds the food in position so that mandibles can act on it. It forms the

roof of the pre oral food cavity.

ii. **Labrum-epipharynx:** Inner surface of the labrum is referred to as epipharynx. It is

frequently membranous and continuous with the dorsal wall of pharynx.

It is an organ of taste.

iii. **Mandibles:** There is a pair of mandibles. They are the first pair of jaws. They are also

called as primary jaws or true jaws. Mandibles articulate with the cranium at two points.

They are heavily sclerotised. They are toothed on their inner border.

There are two types

of teeth. Distal are sharply pointed and are called incisor or cutting teeth and proximal

teeth are called molar or grinding teeth. They act transversely to bite and grind the food

into small fragments.

iv. Maxillae: They are paired and more complicated than mandibles. They are called secondary jaws or accessory jaws. At proximal end the first sclerite **cardo** joins the maxilla to head. The second sclerite is called **stipes** which articulates with cardo. Stipes carries a lateral sclerite called **palpifer** which bears a five segmented antenna like **maxillary palp**. On the distal end of the stipes, there are two lobes. The outer lobe is called **galea** and inner lobe is **lacinia** which is toothed. Maxillae direct the food into the mouth. They hold the food in place when the mandibles are in action. They act as auxiliary jaws and assist in mastication of food. Sense organs connected with the perception of touch, smell and taste are abundantly found in palpi.

v. Hypopharynx : It is a tongue like organ. It is located centrally in the preoral cavity.

Salivary gland duct opens through it.

vi. Labium /lower lip: It is a composite structure formed by the fusion of two primitive segmented appendages. It bounds the mouth cavity from below or behind. It forms the base of the preoral cavity. It consists of three median sclerites *viz.*, **submentum** (large basalsclerite), **mentum** (middle sclerite) and **prementum** (apical sclerite). On the lateral side of the prementum there are two small lateral sclerites called **palpiger** bearing three segmented **labial palpi**. Distally prementum bears two pairs of lobes. The other pair of lobes is called **paraglossae** and inner pair of lobes, **glossae**. Both pairs when fused are called **ligula**.

2. Piercing and sucking / hemipterous / bug type e.g. Plant bugs.

Labium projects downwards from the anterior part of the head like a beak. Beak is four segmented and grooved throughout its entire length. At the base of the labium there is a triangular flap like structure called labrum. Labium is neither involved in piercing nor sucking. It functions as a protective covering for the four **stylets** (fascicle) found with in the groove. Both mandibles and maxillae are modified into long slender sclerotized hair like structure called stylets. They are lying close together and suited for piercing and sucking. The tips of the stylets may have minute teeth for piercing the plant tissue. The inner maxillary stylets are doubly grooved on their inner faces. When these are closely opposed they form two canals viz., food canal and salivary canal through sap and saliva are conducted respectively. Saliva contains enzymes or toxins that can distort plant cell wall to permit the stylets to penetrate down and reach phloem for sucking the sap. Both palps are absent.

3. Piercing and sucking / dipterous / mosquito type : e.g. Female mosquito

Mouthparts of female mosquito consists of an elongate labium which is grooved forming a gutter which encloses six stylets. The stylets are composed of labrum - epipharynx (enclosing the food canal), the hypopharynx (containing the salivary canal), two maxillae and two mandibles. Both the ends of maxillary stylets and mandibular stylets are saw like and suited piercing flesh. The stylets are inserted into host's skin by a strong downward and forward thrust of body. Both mandibles and maxillae are reduced

in male and they feed on plant nectar and juices of decaying fruits. Female pierces the skin of human beings into which it injects saliva containing an anticoagulant (to keep the blood flowing without clotting) and an anesthetic (to keep the victim unaware of the bite) and sucks up the blood. Labium does not pierce but folds up or back as stylets pierce. Maxillary palpi are present.

4. Chewing and lapping type : e.g. honey bee.

Labrum and mandibles are as in biting and chewing type of mouth parts.

But

mandibles are blunt and not toothed. They are useful to crush and shape wax for comb

building; ingest pollen grains and other manipulative functions.

Maxillolabial structures

are modified to form the lapping tongue. The tongue unit consists of two galea of

maxillae, two labial palpi and elongated flexible hairy glossa of labium.

The glossa

terminates into a small circular spoon shaped lobe called spoon or bouton or flabellum

which is useful to lick the nectar.

5. Rasping and sucking : e.g. Thrips

Mouth cone consists of labrum, labium and maxillae. There are three stylets derived from

two maxillae and left mandible. Right mandible is absent. Stylets are useful to lacerate

the plant tissue and the oozing sap is sucked up by the mouth cone. Both maxillary palpi

and labial palpi are present.

6. Mandibulosuctorial type : e.g. grub of antlion

Mandibles are elongate sickle shaped and grooved on the inner surface.

Each

maxilla is elongated and fits against the mandibular groove to form a closed food canal.

The body of the insect victim is pierced by the opposing mandibles and

fluids are
extracted.

7. Sponging type : e.g. House fly

The proboscis is fleshy, elbowed, retractile and projects downwards from head.

The proboscis can be differentiated into basal rostrum and distal haustellum. The

proboscis consists of labium which is grooved on its anterior surface.

Within this groove

lie the labrum-epipharynx (enclosing the food canal) and slender hypopharynx

(containing the salivary canal). Mandibles are absent. Maxillae are represented by single

segmented maxillary palpi. The end of the proboscis is enlarged, sponge like and two

lobed which acts as suction pads.

They are called oral discs or labella. The surfaces of labella are transversed by

capillary canals called pseudotracheae which collect the liquid food and convey it to the

canal. Labella function as sponging organs and are capable of taking exposed fluids.

These insects often spit enzyme containing saliva onto solid foods to liquify them.

8. Siphoning type : e.g. Moths and butterflies

Mouth parts consists of elongate sucking tube or proboscis. It is formed by two

greatly elongated galeae of maxillae which are zippered together by interlocking spines

and hooks. Galeae are grooved on their inner surface and when they are fitting together

closely they form a suctorial food canal through which the nectar is sucked up. The

proboscis is coiled up like watch spring and kept beneath the head when it is not in use.

By pumping of blood into galeae, the proboscis is extended. The other mouth parts are

reduced or absent except the labial palpi and smaller maxillary palpi.

Sources

Qaddo, Ibrahim Al-Jubouri, Hussein Abbas Ali, Mustafa Kamal.1980. Book of General Entomology. University of Baghdad. Number of pages 395.

Nadu Tamil. General entomology. Government arts college (Autonomons) Coimbatore-641018.122 page.

Definition of entomology. <https://www.rvskvv.net>

Richards,O.W.and R.G.Davies.1977.Imms,general textbook of entomology.Imperial college.University of London.934 page.