MORPHOLOGY OF INSECT MOUTHPARTS

Erik Smith

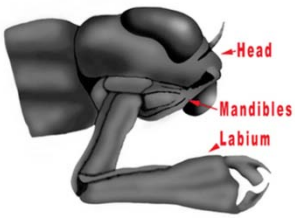
Why should we study mouthparts?

Insects are incredibly diverse organisms, and they fill a variety of niches in their respective ecosystems. Each species is perfectly suited to its role, and their mouthparts have evolved in ways that allow them to effectively exploit their food sources. The differences and similarities between species can also illustrate their evolutionary relationships. All "true bugs" (Family: Heteroptera) have piercing, sucking mouthparts, yet some feed on plants and others feed on other insects (and bedbugs feed on humans). Conversely, beetles (Family: Coleoptera) have mandibles, yet they also have species with varied diets. Whether carnivorous or herbivorous, mouthparts reflect the diet of the respective species:

Feeding habits

I. Solid food diet:





↑ Dragonflies and damselflies (Order: Odonata) are carnivorous and must catch their prey with powerful mandibles as both adults (left) and nymphs (center, right). Nymphs can extend their mouthparts outward via the labrum (right) to snatch prey from the water as it

floats or swims by, but will otherwise keep it folded under their bodies.

↑ White grubs (Order: Coleoptera; Family: Scarabidae) feed on roots, so they must have mandibles capable of tearing into the toughest of plant material. As adults, scarabs use their mandibles to feed on plant foliage.

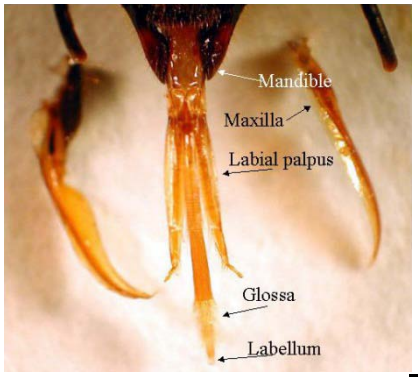
II. <u>Liquid diet:</u>

↑ Female mosquitoes (Order: Diptera; Family: Culicidae) must feed on vertebrate blood in order to reproduce. For them to be successful, their piercing, sucking proboscis must allow them to deftly pierce the skin of their hosts, feed, and leave without incident. While we notice them trying to feed on us quite a bit, their sheer numbers on warm summer evenings let us know that they must be successful much of the time. Feeding with mandibles would likely not be subtle enough to allow them to go unnoticed and survive their meal....

↑ Butterflies (left, center) and moths (right) (Order: Lepidoptera) feed on nectar as adults. In order to reach the nectar deep in flower heads, some lepidopteran proboscises can be quite long. To keep their proboscises packed away during flight, they curl them tightly to their chins, only to unfurl them when feeding.

↑ House flies and other flies (Order: Diptera) lap-up their liquid meals like dogs and cats. In order to do this, they have broad, tongue-like mouthparts that almost act like sponges. The hairs surrounding the “tongue” surface help to trap liquids.

III. <u>Pollen/nectar diet:</u>



↑ Bees (Order: Hymenoptera) feed on liquid nectar and solid pollen. In order to accomplish this, they have *both* mandibles and proboscises. They also use their mandibles for nest construction.

Active learning

This activity may be a fun way to teach the importance of specific mouthparts to respective feeding habits:

1. Provide a student volunteer with two spoons (representing mandibles) and tell them to, without lifting it, obtain water from a bottle (representing a flower- it may be a nice touch to attach fake petals to the lip of the bottle) using the two spoons. Then allow them to try using a straw (representing the proboscis of a butterfly).
2. Allow the student to keep using the straw, and attempt to use the straw to suck up a small square of jello (representing a leaf, or another solid food item), them allow them to try using the spoons. This will demonstrate how mouthparts are relatively suited to different feeding habits.

REFERENCES and RESOURCES:

An excellent resource for in-depth explanation of mouthparts (NC State):

http://www.cals.ncsu.edu/course/ent425/library/labs/external_anatomy/anatomy_mouthparts.html

A well-illustrated guide to the components of the various mouthparts:

http://www.amentsoc.org/insects/fact-files/mouthparts.html

A short description of mouthparts of some other insects:

http://www.backyardnature.net/insmouth.htm