

Mouthpart Madness

Understanding the basic biology of a **pest** is a key component to implementing proper **Integrated Pest Management (IPM)** techniques to manage that pest. In this activity students will explore the four major kinds of **insect** mouthparts and apply that knowledge to devising management techniques.

Suggested Level(s):

Grades 3-5

Adaptable for younger grades

Subject(s):

Environment & Ecology, Arts & Humanities

Standards:

Environment & Ecology

4.5: Integrated Pest Management (IPM)

4.6: Ecosystems and their Interactions

Arts & Humanities

9.1: Production, Performance & Exhibition of Dance, Music, Theatre, & Visual Arts

Skills:

Critical thinking, Participating, Discussing

☛ Technology Connection:

Internet resources, digital camera

Materials:

2 Paper plates

Crackers

Peanut butter

Honey, jelly, or pudding

Straw cut in half

Small soft drink cups with lids and slits for straws

Long-necked wide mouth bottle

Soft rubber or plastic tubing (long enough to reach bottom of bottle)

Time Consideration:

Preparation: 10 minutes

Activity: 20 minutes

Objective(s):

Students will

- identify the four major kinds of insect mouthparts and explain how they work
- examine how specific mouthparts can limit food resources and in what **niche** an organism can survive
- apply insect biology, specifically mouthparts and feeding habits, to pest management techniques

Assessment Opportunities:

- ☛ Students can research and build an anatomically correct insect using various materials. Younger students can paint a rock to look like their insect. Set up specific requirements for the project.

Possible guidelines:

- Model must be an insect or other arthropod
- Model must be accurate in shape, color, anatomy, and proportions
- Write a description of the insect and include
 - Common name of the insect
 - Where it's found (geography)
 - Describe it's habitat and what it eats
 - Describe when and why this insect may be considered a pest or why it's not considered a pest
 - Explain IPM tactics that can be used to manage this pest

Some of these guidelines were taken from Pennsylvania State University's Build-a-Bug contest rules. Go to

<http://entscied.cas.psu.edu/Fair.html> for more information on entering this contest. Or you can hold your own!

Background:

The old adage "you are what you eat" takes on a different twist with insects. When **arthropods** came on the scene, the main new **adaptation** they had was jointed appendages, including the complex workings of the insect mouth. This was very different from their worm-like ancestors. The same basic moveable pieces of machinery that make up the insect mouth have been modified in several key ways to allow the

insects to specialize on certain food types. Consequently, if a certain type of damage is present on a leaf, whole groups of insects are either implicated or exonerated.

There are four basic types of insect mouthparts: chewing, piercing/sucking, sponging/lapping, and siphoning. **There are also some adult insects, such as the mayfly, which do not have any mouthparts because they don't feed as an adult.** The chewing mouthpart can rip, bite, and tear food. Examples of insects with chewing mouthparts include caterpillars, cockroaches, ants, and grasshoppers. Piercing/sucking mouthparts work like a syringe. They are long tubes that are pierced into plant or animal tissue and suck out fluid or blood. Insects with this type of mouthpart include aphids and mosquitoes. The next type of mouthpart is the sponging/lapping mouthpart. The housefly is a common insect pest with this mouthpart. They extend a tongue-like structure to the surface and lap up or absorb the liquid like a sponge. **Sometimes the food source is not liquid so the insect first spits on the food to make it liquid and then laps it up.** Siphoning is the final basic type of mouthpart, and it works like a straw. Moths and butterflies siphon up nectar from flowers. As some organisms go through their life cycles, their mouthpart changes. **For example, the larval stage of a butterfly is a caterpillar, which has chewing mouthparts, different from the adult stage. The two stages occupy different ecological niches in an ecosystem.**

An ecological niche can be defined as the location and role or job for which a species is well suited within its community, including its habitat, what it eats, its activities, and its interactions with other living things. Different species can compete for the same niche, but will not occupy the exact same niche for very long. For example, a mammal, bird or insect may compete for the same flower resource, nectar. Each organism can extract the nectar successfully because of special adaptations. Not all organisms can occupy this particular niche for various reasons, including feeding methods. When dealing with pest species such as insects, it important to understand the biology and life cycle of the organism and to know what niche it occupies when designing an appropriate IPM plan.

Getting Ready:

1. Set the following items out on a table:
 - small cup containing water with “to-go” lid (fill with enough water for the straw to reach it)
 - one long-necked bottle with a little water in the bottom
 - one paper plate with honey, jelly, or pudding on it
 - one paper plate with peanut butter holding a cracker up on edge
 - other various “cups and lids” (if available) with different levels of water in them

Doing the Activity:

1. Select four volunteers to form the insect team.
2. Instruct each person to put their hands behind their back. Hands cannot be used in this activity.
3. Assign each person an insect type and the associated mouthpart. Hand out the straw and tubing accordingly. (Additional pests and items can be added at the teacher’s discretion)

<u>Insect</u>	<u>Type of mouthpart</u>	<u>Use in activity</u>
Tobacco Hornworm caterpillar	Chewing	Can only use teeth
Squash bug	Piercing/sucking	Can only use straw
Housefly	Sponging/lapping	Can only use tongue

Butterfly

Siphoning

Can only use tubing

4. Instruct the team to go after the kind of food they can eat on the table in front of them. Remember, no hands!!
5. Ask the “insects” questions as they are trying to get to the food sources: “Housefly, can you eat leaves?” (The cracker stuck in the peanut butter represents a leaf) “Caterpillar, can you drink nectar from a flower?” (The water inside the cups and bottles represents nectar) “Squash bug and butterfly, can you feed from the same source as the other insects?”
6. Discuss with students how knowing the mouthpart of an insect can help with finding the correct IPM tactics to use if the insect is considered a pest. Points to emphasize:
 - By looking at the damage on a plant, determine the type of mouthparts that could cause the damage. This can eliminate or implicate specific insect groups. Proper identification of the pest is the first step in IPM!
 - If in the IPM plan it is decided to apply an insecticidal soap or other pesticide, will it affect the pest? For example, if you apply a chemical on the leaf surface that will kill an insect only when the leaf is eaten, it won’t affect an insect with a piercing/sucking mouthpart (Why not?). So not only was the pest not managed, but the chemical may kill beneficial insects with chewing mouthparts occupying that niche.

Enrichment Activities:

1. 🐞 Take students outside and around the school property to look for evidence of pests and damage to plants. Collect various leaves exhibiting damage and decipher what type of mouthpart could have caused the damage. **Observe the surroundings where the plant was collected to see if there are any insects that may be the cause of the damage.** Use a digital camera to record the findings. If you cannot take students outside, bring in a collection of damaged plant parts inside the classroom for study and research possible culprits of the damage.

For Younger Students:

1. Limit the number of mouthparts being studied to chewing mouthparts and siphoning mouthparts. Allow students to practice “eating” with these two mouthpart types. Purchase caterpillars, such as Painted Lady caterpillars and have students observe the eating patterns of the caterpillars. Eventually the caterpillars will enter the **pupal stage** and emerge as Painted Lady Butterflies, which have siphoning mouthparts. Students can observe the butterfly mouthparts before releasing them into the wild and then watch which food sources the butterflies prefer.

Reading Connection: Depending on how they are used in the classroom, the following books can address the PA Reading, Writing, Speaking, and Listening Standards 1.1: Learning to Read Independently and Standard 1.2: Reading Critically in All Content Areas.

Hickman, Pamela. *Starting with Nature: Bug Book*. Kids Can Press. 1999.

Introduces students to a variety of common insects found in the United States. Includes several insect activities. Grades 3-6. ISBN: 1-55074-653-7

Whalley, Paul. *Eyewitness Books: Butterfly & Moth*. Dorling Kindersley Limited. 1988.

In-depth look at the life cycle and behaviors of many butterfly and moth species. Pictures are excellent. Grades 4-8. ISBN: 0-394-89618-1.

Rosenblatt, Lynn M. *Monarch Magic: Butterfly Activities and Nature Discoveries*. Williamson Publishing Company. 1998.

Focuses on the migration, life cycle and characteristics of Monarch butterflies. Includes various activities useful to the study of Monarch butterflies and the preservation of the species. Grades 3-8.

ISBN: 1-885593-23-6.

Lyn Garling with the PA IPM Program at the Pennsylvania State University developed "Mouthpart Madness"