THE SOLANACEAE
LESSON SEVEN
Insect Pests of the Solanaceae

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In this lesson we will study the insect pests of the Solanaceae. Parts of the lesson are underlined. Younger members can ignore these parts. **Make sure you do everything that is in bold print,** answer all the questions and do one of the projects at the end of the chapter. WORDS PRINTED IN ALL CAPITALS are in the glossary at the end of the chapter.

INTRODUCTION

Most insects do not harm plants. If fact, many insects are necessary so that certain plants can complete their LIFE CYCLE. These insects are involved in POLLINATION. We will learn more about pollination in another lesson. In this lesson we will learn about insects that are considered pests for potatoes, tomatoes, and peppers. Insects are classified as pests if they can damage plants and reduce the harvest. Remember! Many insects and all spiders that are found in the home vegetable garden are beneficial. We do not want to destroy or control them.

A. INSECT PESTS

Some insects do damage plants. About 14% of the world's crops are lost to insect damage. Some insect pests are called KEY PESTS. These pests feed on the harvested portion of the plant. Two examples of KEY PESTS are the corn earworm and the tomato fruit worm. They can destroy the corn ear. These insects directly reduce the harvest. Other pests feed on parts of the plants that are not harvested. These insects can reduce the health of the plant. Unhealthy plants have lower harvests. These pests indirectly reduce yields.

Insects may damage plants in several different ways. Some insects harm plants because they use plants for egg laying. Some insects feed on leaves, stems, roots or flowers. These insects are called PHYTOPHAGOUS: These insects use the plant for food. Often these insects defecate on plants. Their excrement, FRASS, can be brown, black or green and resemble small flecks or balls. Insects can damage plants at different stages in their life. Some damage plants as LARVA, some as adults, some at all stages of their LIFE CYCLE.

B. INSECT MOUTHS

Feeding is done by either chewing or sucking. Insects with 'cutting' mouthparts tear the plant and chew it. Examples of chewing insects are beetles, caterpillars

and grasshoppers. These insects feed on plant and often leave holes in the plant parts. Some insects have piercing mouthparts. They insert their mouth part and suck liquids from the plant. Other insects have mouth parts similar to straws and suck liquids without piercing the plant. How do these mouth parts differ from each other? Below you will see a generalized insect head with chewing mouth parts. **Find the mandible and circle.**

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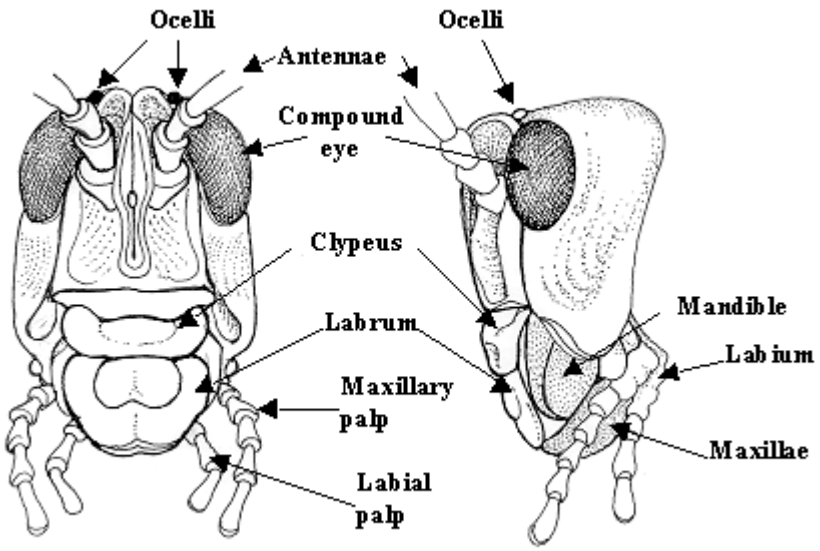
<td> 
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<td>Used with permission, Department of Entomology, North Dakota State University.</td>
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<td>“Mouthparts - labrum and 3 sets of paired and modified appendages. Listed from the most anterior to most posterior.

1. Labrum - plate (sclerite) that serves as upper lip in insects with chewing mouthparts. Helps to pull food into the mouth.
2. Mandible - paired appendage of the 4th body segment that becomes the 1st pair of mouthparts, analogous to jaw. Used to chew, cut, and tear food, to carry things, to fight, and to mold wax. Move from side to side rather than up and down.
3. Maxillae - 2nd pair of feeding appendages, used for food handling and sensing. More complicated than the mandibles but working in the same manner.
4. Labium - fused, 3rd pair of feeding appendages, analogous to lower lip. They function to close the mouth below or behind. Evolved from paired maxillae-like structures that are fused along the center line.”</td>
<td>Used with permission, Department of Entomology, North Dakota State University.</td>
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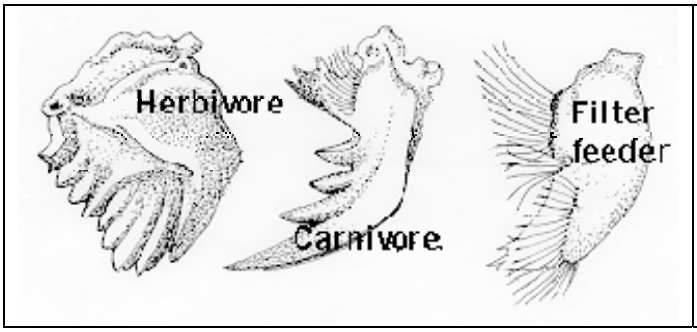
Mandibles come in different shapes depending on the insect's food source. Below are some examples.



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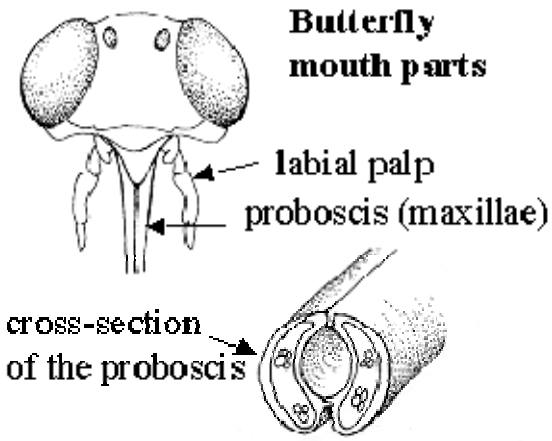
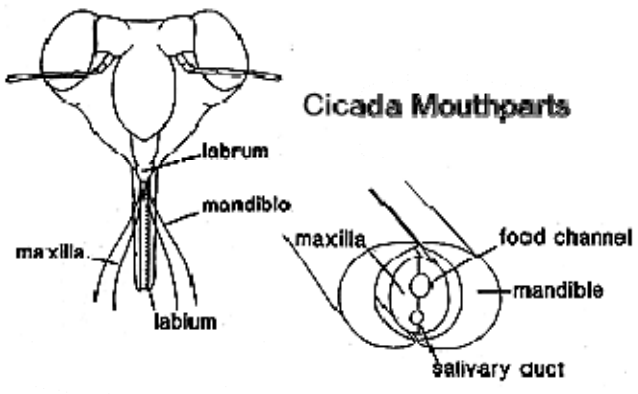
Circle the mandible type you think plant eating insects have.

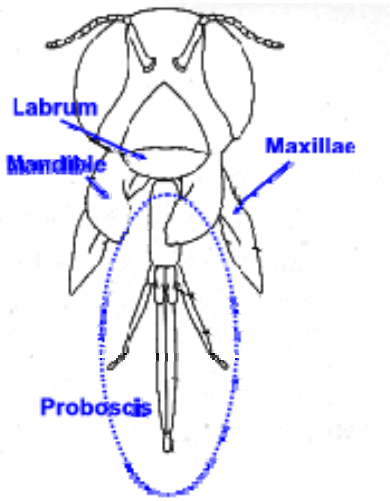
Below are a set of diagrams showing different types of mouth parts of insects using plants as foods. Look carefully and try to understand how each type of mouth part is able to use the plant as food. Text and drawings below used with permission, Department of Entomology, North Dakota State University.



"Siphoning - Moths and butterflies. When feeding the proboscis is uncoiled and extended. Nectar is sucked up into the mouth or oral cavity. The proboscis is a modified maxillae."



"Piercing-Sucking - Found in a variety of insects, such as herbivorous and predacious bugs and mosquitoes. Mandibles and maxillae are formed into stylets which are enclosed by the labium. Once the stylets penetrate, a secretion is injected to dissolve tissue, act as a toxin in predacious species, or as anticoagulant for mosquitoes."

	**"Chewing-Lapping** - Adult honeybees and bumble bees. Mouthparts are modified to utilize liquid food, honey and nectar. A central "tongue" is used to draw liquid into the body. The mandibles are not used for feeding but function to cut floral tissue to gain access to nectar, for defense, and for manipulating wax."

More drawings of mouth parts can be seen at
http://www.bumblebee.org/invertebrates/Hexapoda.htm

C. INTEGRATED PEST MANAGEMENT

How do we handle insect pests? Modern agriculture uses a program called Integrated Pest Management or IPM. You can use IPM in your home garden as well.

What is IPM? In the Proceedings of the National Integrated Pest Management Forum, IPM is defined as:

> "Integrated Pest Management is the coordinated use of pest and environmental information along with available pest control methods, including cultural, biological, genetic and chemical methods, to prevent unacceptable levels of pest damage by the most economical means, and with the least possible hazard to people, property, and the environment".

The foundation of IPM is that there will always be some insect pests. To have control does not mean that ALL the insects have to be destroyed. Every farmer and gardener can accept a certain number of insect pests and a certain level of damage. Each farmer and gardener decides what that acceptable level is.

Once the farmer or gardener decides how much damage to accept, they learn to identify damage and insects. Then, they use cultural, biological, genetic and chemical methods to control insects they do not want.

Read *Integrated Pest Management for the Home Vegetable Garden*, at the end of the lesson or at http://ohioline.osu.edu/hyg-fact/2000/2205.html Answer the questions at the end of the lesson.

Remember, INSECTICIDES are chemicals which are used to control insects. They should only be used with parental supervision. Instead of using insecticides, try keeping your plants weeded and well watered. Check your plants each day, destroy the insect pests you see. Don't forget to look at the underside of leaves and the stems too.

D. Classification

The corner stone of IPM is identifying insect pests. To identify insects it helps to know something about TAXONOMY. Animals are classified into the animal kingdom. The animal kingdom is then further divided into increasingly smaller groups based on similarities of animals in the group. These groups and names of animals (as well as plants) are named by TAXONOMISTS (scientists who study how to classify living things).

The standard groups in a typical complete classification of a SPECIES are the following (the example is for a honey bee, Apis mellifera Linnaeus):

Kingdom: Animal
Phylum: Arthropoda
Class: Insecta
Order: Hymenoptera
Family: Apidae
Genus: *Apis*
Species: *melliferae*

Insects belong to the phylum Arthropoda. All the animals in this phylum have segmented legs and bodies. They also have EXOSKELETONS (skeletons on the outside rather than the inside of their bodies). Some animals which are arthropods are spiders, ticks, mites, centipedes, millipedes, shrimp, lobsters, and insects.

Insects are in the class Insecta (also called Hexapoda). Most adult insects have the following characteristics:

1. body divided into three distinct parts: head, thorax and abdomen,
2. three pairs of legs,
3. one pair of antennae and one pair of compound eyes (some exceptions), and
4. two pairs of wings (absent in some, others with only one pair).

There are about 30 orders of insects. TAXONOMISTS disagree about the number of orders and their names. The insect pests of the Solanaceae fall into three orders: Coleoptera, Lepidoptera and Hemiptera.

Coleoptera

The order Coleoptera, the beetles, has the largest number of animal species. There are over 280,000 beetle species all over the world. One in five living animals is a beetle, one in four insects is a beetle. Some beetles eat living plants while some prey on other animals. Beetles are also scavengers, living on dead organisms. They include the best know and most important insect pests.

The Coleoptera range from being microscopic to over 2 inches long. They have two pairs of wings. The front pair are thick and form a hardshell of the abdomen of most beetles. The wings meet in a straight line down the middle of the back of the beetles. A few beetles have short front wings. The back wings are thin and fold over the front wings when at rest. Mouthparts are usually formed for chewing. A few suck. Immature beetles have six legs or can be legless and maggot-like. They are called grubs.

Lepidoptera

The Lepidoptera are a large order. They are well known both as significant plant pests and as the beautiful butterflies we all love.

As adults, the Lepidoptera usually have four well developed wings covered with overlapping scales . Most have mouth parts that are formed for sucking

Butterflies generally fly during the day and have clubbed antennae. Skippers are much like butterflies but have hooked antennae. Moths generally fly at night and have antennae that are linear or feathery but not clubbed. Adults range from ¼ inch to over 3 inches.

Immature stages (LARVAE) are known as caterpillars. Many caterpillars have names like cutworms, armyworms, and hornworms. Mouthparts of the LARVAE are formed for chewing. Caterpillars feed on many different plant parts. Some feed on leaves, while others are leafminers (boring into leaves). A few bore into herbaceous and woody plant stems. Some caterpillars are even predators. All Lepidoptera undergo a complete metamorphosis.

Hemiptera

Hemiptera usually have four wings. They are folded flat over the body. Often, there is a visible triangle at the center of the back called the SCULTELLUM. The wing bases do not cover this area. The front pair of wings are thickened and leathery at the base with membranous tips or ends. Mouthparts are formed for piercing and sucking. There is a beak at the front part of the head.

Hemiptera are found on plants and animals, even sometimes biting humans. They prey on other insects and some damage plants.

Immature members look like the adults but do not have wings. Most are under 1/2-inch long but some forms especially aquatic ones may be over 2 inches long.

E. Solanaceae Pests

The insect pests of the Solanaceae are:

Potato	Tomato	Pepper
Colorado Potato Beetle	Colorado Potato Beetle	
Flea Beetles	Flea Beetles	Flea Beetles
Green Peach Aphid	Green Peach Aphid	Green Peach Aphid
Potato Aphid	Potato Aphid	Potato Aphid
European Corn Borer	European Corn Borer	European Corn Borer
Potato Leafhopper		
Grasshoppers	Grasshoppers	Grasshoppers
Wireorms		
	Hornworms	
	Tomato Fruitworm	Tomato Fruitworm
	Stink Bug	Stink Bug
	Variegated Cutworms	

Learn to adult and immature insects using the Solanaceae Pest Fact Sheet .

LABORATORY FOR LESSON SEVEN

1. Do the insect body part labeling at
http://www.uky.edu/Ag/Entomology/ythfacts/4h/unit1/labgrass.htm

2. Go through the lesson on insects at

http://www.urbanext.uiuc.edu/insects/01.html

Another good site is

http://www.ivyhall.district96.k12.il.us/4th/KKhp/1insects/buginfo.html

Be able to: identify at least 6 parts of an insect; identify the different types of mouths, know what a larva and nymph are.

EXERCISE FOR LESSON SEVEN

Questions for Lesson Seven

Answer the questions.

1. What is an insecticide?

2. What is a key pest?

Glossary

defoliate - to remove all the leaves.
exoskeleton – hard exterior of insects
frass – insect excrement
insecticide – substance which will kill insects
life cycle - the growth and development of a plant from seed to mature plant producing new seeds.
larva and larvae- an immature insect. Larva is singular, larvae is plural.
monoculture - when only one type of crop is grown
pest- a problem insect (or other animal)
phytophagous- plant eaters.
pollination- the transfer of pollen.
scutellum- shieldlike bony plate or scale, as on the thorax of some insects
species-– a group of similar organisms which breed only among themselves
taxonomist - scientists who study classifications