4-H

Natural Resource

Club

Entomology

Entomology

The study of insects is called *entomology* (en-toe-mol-o-gee). The 4-H entomology curriculum, *Teaming with Insects*, was written for youth who enjoy learning about science and nature by studying insects. Level 1 introduces the world of insects. Activities focus on how insects look and move. This provide necessary background for studying important entomology topics. The Level 1 Entomology manual, *Teaming with Insects,* is intended for youth in grades 3-5.

Level 2 shows youth how to make insect collection tools and expands on the basic concepts of biodiversity, invasive species, integrated pest management, and forensic entomology. Level 3 delves even deeper into the basic concepts and encourages youth to take control of their learning by completing self-directed research using the scientific method and reference materials.

Who Needs an Entomologist?

Nearly everyone! Police, working with a forensic entomologist, use insects to offer clues in criminal investigations. Doctors need insect information to help people with insect-carried diseases. Homeowners need entomologists to help prevent damage to homes and plants. Teachers use insects in the classroom to teach about living things. Farmers must understand insect biology to prevent insects from damaging crops. Writers create fascinating stories about insects to educate and entertain us. People in industry need to understand insects to manage them better. Some military scientists study exotic insects and the diseases they carry to protect our troops.

Youth will benefit from the study of insects because they are found everywhere, and youth will be in contact with them throughout their life.

Indiana 4-H Entomology manuals

(Order from Purdue's *The Education Store*: www.the-education-store.com)

- ❑ Creepy Crawlies (#BU-6853)
- ❑ What's Bugging You? (#BU-6854)
- ❑ Dragons, Houses, and Other Flies (#BU-6855)
- ❑ Helper's Guide (#BU-6856)
- ❑ Indiana Entomology Project Leader's Guide (online only, #4-H-890)

Invited Speaker Suggestions

Local people who work with or have knowledge of insects:

- ❑ County Agricultural & Natural Resources Extension Educator
- ❑ FFA advisor who competes in the 4-H/FFA Entomology Career Development Event (CDE)
- ❑ Farmer
- ❑ Pest Control Specialist
- ❑ Grain Elevator/Storage Manager

Resources

- ❑ Indiana 4-H Entomology webpage: www.four-h.purdue.edu/natural_resources/, click on entomology
- ❑ National 4-H resource website, www.4-h.org/curriculum/entomology
- ❑ *How to Make an Awesome Insect Collection*! (The Education Store, #ID-401)

4-H/FFA Entomology Career Development Event

Youth who like to compete with others might enjoy participating in the 4-H/FFA Entomology Career Development Event (CDE). The Entomology CDE Objectives are:

- ❑ Develop leadership skills and practice good study habits
- ❑ Learn about: Insect damage to field crops, ornamentals, fruits, livestock, stored products, and homes
- ❑ Insects and public health, pesticides, and insect control methods
- ❑ Learn to identify insects (by order, family, and common name)

Teams compete in their Area CDE. Winning teams may advance to the Indiana Entomology CDE, generally held the second Saturday in December. Contact your county Extension Educator for the date of your Area contest. Information to help you prepare a team for this contest is available at http://www.four-h.purdue.edu/Natural_resources/career.html. General information about the 4-H/FFA CDEs is available at: www.four-h.purdue.edu/cde/.

Prepared by Natalie Carroll, Professor, and Tyler Wilson, Graduate Student, Department of Youth Development and Agricultural Education, Purdue University.

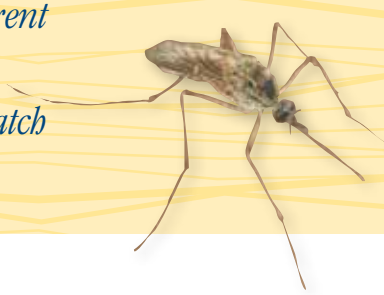
Activities

The following activities were selected from the Indiana 4-H Entomology Level 1 manual to introduce entomology, the study of insects, to your 4-H Natural Resources club. This manual was written using the *Experiential Learning* model. We recommend that you allow youth to do the activity (experience) as suggested in the manual, giving help as needed. Be sure to discuss the *Talk it Over* section (share, apply, and generalize).

Pages	*Activity Objective*	*Materials Needed*	*Time (min.)*
Big Mouth Bugs			
7	Youth will learn about the different insect mouth types.	Sponge, syringe, pliers, party blower and copy of page 7 for each youth	15-20
Pit Stops			
12-13	Youth will collect and record the ground crawling insects they find in three different locations. You can set this activity up ahead of time if necessary, but youth will learn more if they set the traps and review and record data over a period of days.	3 cups, paper clip, bait, small pieces of board, small rocks, 3 small containers, and copies of pp 12 & 13 for teams of youth	30
Alien Insects			
17-18	Youth will begin to learn about invasive insect species through this Word Scramble and discussion. See the "websites" link at the Indiana 4-H Entomology website for supporting information.	Copy of page 17 for each youth	20-30
Where Are They?			
22-23	Youth will search for clues of insect activity by performing an "insect survey."	Copies of page 22 and a flashlight	20-30
Ants and Uncles			
24-26	Youth will collect small bugs (insects and arthropods) and study them to learn which are which.	Copy of page 25 for each youth or teams, plastic cups, cardboard, container with holes in lid	20-30
Chirp, Chirp			
29-30	Youth will observe cricket behavior and communication at different temperatures and light conditions. Assign each team a different place (with different conditions) and discuss the differences in the data they collect.	3-5 male crickets, clear plastic container, sand, potato, water bottle, cotton ball, and copy of page 29 for each team of youth	60
I Eat Insects			
33-34	Youth learn about some of the animals that eat insects by completing the "Fill in the blank" sheet and discussion.	Copy of page 33 for each youth	15

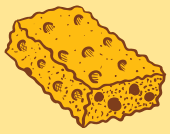
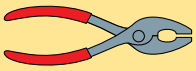
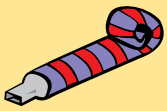
Activity 4: Big Mouth Bugs

Insects are the most successful group of animals in the world. This is because different species are adapted to many different habitats. For example, differences in mouth types allow insects to eat many different kinds of foods. In this activity you will match the mouth types with a common object that works much the same way.



DO it Mouths to Feed

- Draw a line from the Common Object to the Mouth Type it describes.
- Draw a line from the Mouth Type to the Insect that has that mouth type.

Common Object	Mouth Type	Insect
 •	• Chewing: Crushing mouth parts used to tear chunks of leaves or other types of food. •	• Mosquito
 •	• Piercing/Sucking : Long thin mouth parts used to poke into food source. •	• Grasshopper
 •	• Siphoning: Long coiled tube used to suck up liquid. •	• House fly
 •	• Sponging: Soft tissues used to mop up liquids. •	• Butterfly

Dig Deeper

Collect three insects and identify the mouth type each has.

Life Skills

ENTOMOLOGY SKILL: Learning insect mouth types.

SCIENCE STANDARD: Studying form and function, biological evolution.

SUCCESS INDICATOR: Ability to describe different inset mouth types.

Talk It Over

SHARE WHAT HAPPENED: Describe different insect mouth types to a friend or helper.

APPLY: How might having different mouth types help insects survive in different habitats?

GENERALIZE TO YOUR LIFE: What tools do people use to help them eat and drink different kinds of food?

Activity 7: Pit Stops

Have you ever gone hunting? Get ready, because in this activity you will be a hunter of very small game: insects. You won't have any trouble finding them. There are over 1 million different kinds! There are many ways to capture insects. In this activity you make and use a pitfall trap to collect insects that walk on the ground.

MAKE it Pitfall Trap

Tool Kit

- ☐ 3 plastic or foam cups
- ☐ Paper clip
- ☐ Bait (bread, fruit, lunch meat)
- ☐ 3 small pieces of board
- ☐ Small rocks
- ☐ 3 containers
- ☐ Trap Table data sheets

- Ask your helper to punch a few small holes in the bottom of your three cups with an open paper clip. This allows water to drain out.

FACT! Featherwing beetles are among the smallest known beetles. Some are less than 0.039 inches long.

DO it Pitfall Trap

Choose three different habitats to place your pitfall traps. Examples of habitats are in a lawn, under a tree or shrub, near water, in a ditch, in the woods.

- Ask for help to dig three holes and set the cups in them. Position the top of the cup even with the soil surface.
- Place your bait in the bottom of each cup. Use the same bait in each cup.
- Place a board over the top of each cup. Elevate the board above the ground by placing small rocks under it. This leaves space for insects to walk under and reach the cup.
- Empty each cup into another container each day for three days. Count the insects and other organisms collected and record them in the Trap Tables (or make your own). Add bait if necessary.
- Count the number of beetles, ants, and crickets that you collect. Ask for help if you are not sure how to identify them.

Trap Table 1

Location: _____

Bait: _____

Date set: _____

Date examined	Total number of insects	Beetles	Ants	Crickets	Other
1.					
2.					
3.					

Trap Table ❷

Location: _____

Bait: _____

Date set: _____

Date examined	Total number of insects	Beetles	Ants	Crickets	Other
1.					
2.					
3.					

Trap Table ❸

Location: _____

Bait: _____

Date set: _____

Date examined	Total number of insects	Beetles	Ants	Crickets	Other
1.					
2.					
3.					

Dig Deeper

- Use different kinds of bait.
- Collect insects in different habitats.
- Collect insects at different times of the year.
- Learn how to use insects to make a collection at www.4-H.org/curriculum/entomology.

Life Skills

ENTOMOLOGY SKILL: Collect insects using a pitfall trap.

SCIENCE STANDARD: Learning a collecting skill.

SUCCESS INDICATOR: A collection of ground walking insects.

Talk It Over

SHARE WHAT HAPPENED:

- How many insects did you collect?
- Did you collect different types of insects in different places?

APPLY: How could a pitfall trap be used to choose the best place to put a sandbox?

GENERALIZE TO YOUR LIFE: Why is it important to collect data from different habitats?

Activity 9: Aliens Insects

A healthy ecosystem has a balance between animals and plants competing for space, food, and water. Sometimes new species are introduced to an area that, either on purpose or by accident, upset the natural balance in the area.

DO it Invasive Species Scramble

Unscramble the letters in the list below to complete the invasive insect names and read about the damage they cause.

Africanized _____ **(eeeobhny)**
More aggressive toward humans than the European honeybee, it also takes over existing hives.

Asian Long-Horned _____ **(eeeblt)**
Larvae destroy many species of hardwood trees by boring deep into the heartwood and robbing the tree of nutrients, eventually killing it.

Asian Tiger _____ **(iooumstq)**
Can transmit viruses such as Eastern equine encephalitis and West Nile virus.

Common Pine Shoot _____ **(elteeb)**
Larvae feed on the shoots of pine trees, causing a reduction in tree height and growth.

Emerald Ash _____ **(eobrr)**
Larvae tunnel under the bark and disrupt the transport of water and nutrients, eventually killing the tree.

Gypsy _____ **(ohmt)**
Larvae (caterpillars) defoliate (remove leaves) of many types of trees.

Light Brown Apple _____ **(thom)**
Larvae (caterpillars) feed on a variety of foliage and fruit crops, causing significant damage.

Mediterranean _____ **(iufrt yfl – 2 words)**
Attacks over 400 species of plants, including many species of citrus and vegetable crops.

Mexican _____ **(rtiuf lyf – 2 words)**
Larvae destroy numerous fruits of economic significance, particularly grapefruit, oranges, pear, peach, and apple, by causing them to rot.

Red Imported _____ **(eifr atn – 2 words)**
Can attack and cause painful stings on humans, pets, and livestock.

Russian Wheat _____ **(aidhp)**
Introduces a toxin as it feeds, stunting plant growth and preventing proper grain maturation in cereal crops like wheat and barley.

Silverleaf _____ **(eiyfhltw)**
Damages crops by feeding on them and transmitting viruses.

Sirex _____ **(aoodpsww)**
Feeds on several species of pine trees and introduces a fungus that kills pine trees.

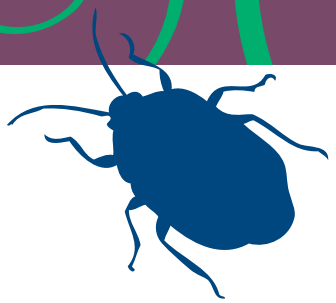
Soybean Cyst _____ **(aeeodmnt)**
Causes stunted growth and reduced yields of soybean crops.

WORD BANK

Unscramble the words you can. Then, check them off and use the remaining words to finish the activity.

☐ aphid	☐ borer	☐ fruit fly	☐ moth	☐ whitefly
☐ beetle	☐ fire ant	☐ honeybee	☐ moth	☐ woodwasp
☐ beetle	☐ fruit fly	☐ mosquito	☐ nematode	

Activity 9: Aliens Insects



Life Skills

ENTOMOLOGY SKILL: Learning about invasive species.

SCIENCE STANDARD: Behavior of organisms.

SUCCESS INDICATOR: Ability to name three invasive insect species.

Talk It Over

SHARE WHAT HAPPENED: How difficult was it to unscramble the letters to make a word?

APPLY: Do you have any of these invasive species where you live?

GENERALIZE TO YOUR LIFE: Why does the government try to keep invasive insects out of the country?

FACT! The domestic honey bee is not native to North America. English settlers brought bees to North America in 1622.

Activity 11: Where Are They?

Before you can begin to control insect pests, you need to find out what insects are present, where they are, and determine if the problem is big or small. In this activity you survey in and around your home for insect pests.

Finding Insects

Tool Kit

- ☐ Flashlight
- ☐ Pencil
- ☐ Insect Pest Inventory data sheet

- Look carefully both inside and outside your home for insect pests. Only list insect *pests*. (For example, people are happy to have a monarch butterfly on their bushes outside the house and do not want to control them, so they're not considered pests.)
- Look for signs of insect activity, such as holes in leaves, webs, anthills, tunnels, dead insects, live insects, and wood damage.
- Decide whether it's a big problem (you have to do something about it) or a small problem (you can live with it).
- Record your findings in the Insect Pest Inventory data sheet below or make your own.

Insect Pest Inventory

Location	Insects Found/Signs of Insect Activity	Problem Level	
		Big	Small

Dig Deeper

- Discuss control measures for the insect pests that you find with a helper.
- Learn how to use insects to make a collection at www.4-H.org/curriculum/entomology.

Insect Facts – Biological Control

Some insects are pests because they eat the foods we eat and live in places where we live. Some pest insects feed on humans and other animals. It is important to control insect pests without doing damage to the environment. Entomologists have developed many tools to control insects. Biological control uses other living things to control insects. Some of the major biological control agents are listed in the table.

Method of Control	Biological Control Agents Used
Predators	Lady beetles, ground beetles, mites, dragonflies, mantids, assassin bugs, robber flies, hister beetles, rove beetles, checkered beetles, blister beetles, velvet ants, spiders, lacewings, ants, damsel bugs, stink bugs, minute pirate bugs, flower flies, marsh flies, hunting wasps
Parasites	Ichneumon, braconids, chalcids, tachnid flies, humpbacked flies
Pathogens	Bacteria, fungi, viruses, protozoans

Life Skills

ENTOMOLOGY SKILL: Determining the scope of an insect pest problem.

SCIENCE STANDARD: Making observations.

SUCCESS INDICATOR: Identifies insect pests and level of problem.

Talk It Over

SHARE WHAT HAPPENED: Where did you see the most insects or signs of insect activity?

APPLY: What non-chemical control measures could help reduce insect pest populations?

GENERALIZE TO YOUR LIFE: Why is it important to take an inventory before tackling a problem?

FACT! Nearly 17% of the human population suffers from allergies to cockroaches and the house dust mite.

Activity 12: Ants and Uncles

Many people call any small bug an insect. Some small bugs are not insects, but they are insect relatives. In this activity, you compare insects with their non-insect relatives.

DO it: Identifying Insects and Their Relatives

Tool Kit

- ☐ Clear plastic cup
- ☐ Stiff cardboard
- ☐ Container with holes in the lid
- ☐ Insects and Relatives data sheet

- Look under rocks, leaves, boards, and other debris for insects and their relatives.
- Use a clear plastic cup and a sheet of stiff cardboard to collect ground dwellers.
- Quickly place the cup over the insect or relative.
- Carefully slide the cardboard under the cup taking care not to injure the specimen.
- Put the specimen into another container with a lid that has small holes so that the specimen can breathe.
- Collect about 10 specimens and take them home to study.
- Use the Insects and Relatives data sheet to decide which specimens are insects and which are not. A magnifying glass will help you see body part details more easily.
- Draw a picture of your specimens in the space provided.

These are NOT insects. See if you can match these Common Insect Relatives to their descriptions on page 25.

FACT! Insects and their relatives are animals (Kingdom: Animalia) that belong to the group (phylum) called Arthopoda.

Insects and Relatives

Insect Characteristics

Body divided into three regions: a head, thorax and abdomen.

One pair of antennae.

Three pairs of legs.

Some adult insects have one or two pairs of wings.

Common Insect Relatives

Spider - four pairs of legs, no antennae.

Centipede - more than five pairs of legs, body flattened, one pair of legs per body segment.

Millipede - more than five pairs of legs, body round, usually with two pairs of legs per body segment.

Sowbug - seven pairs of legs, body like an armadillo, small, gray.

Insects I Found (drawings)

Insect Relatives I found (drawings)

Activity 12: Ants and Uncles

Life Skills

ENTOMOLOGY SKILL: Insect classification, observing, collecting.

SCIENCE STANDARD: Critical thinking, social skills.

SUCCESS INDICATOR: Ability to distinguish between insects and insect relatives.

Talk It Over

SHARE WHAT HAPPENED: What insects and insect relatives did you collect?

APPLY: What are the major differences between insects and their relatives?

GENERALIZE TO YOUR LIFE: What distinguishing characteristics does a dog have?

FACT! Arthopoda have segmented bodies and jointed appendages (legs and antennae).

Activity 14: Chirp, Chirp

Crickets are found around buildings and in fields and meadows. Sometimes you'll find them by following their chirps. The speed (fast or slow) of their chirp depends on the temperature. You can collect crickets in the summer or do this activity anytime during the year if you buy crickets at a pet or bait store.

DO it Cricket Observations

Tool Kit

- ☐ 3 to 5 Crickets
- ☐ Clear plastic container
- ☐ Sand, potatoes or carrots
- ☐ Water bottle and cotton ball

- Collect or purchase 3 to 5 crickets. Make sure you have at least one male, since females do not chirp. (The female cricket has a long ovipositor on the end of her abdomen.) To collect your own crickets, do it in late summer or early fall when adult crickets appear. Use an insect net to gently capture crickets.
- Put a shallow layer of sand in the bottom of a small, clear container. Punch small holes in the lid of the container so the crickets can breathe.
- Place small pieces of potatoes or carrots in the container for the crickets to eat.
- Place a small bottle filled with water and a cotton ball plug so the crickets have water. Place the crickets in the container and secure the lid.
- Watch and listen to the crickets for five minutes, three times a day, for three days. Include day and night observations. Record what you see and hear.

Day	Time	Sounds (# chirps/minute)	Observations
❶			
❶			
❶			
❷			
❷			
❷			
❸			
❸			
❸			

Activity 14: Chirp, Chirp

Dig Deeper

- Repeat this experiment at a different temperature. Avoid extremely hot or cold temperatures that can kill the crickets.
- Watch your crickets in total darkness using a small flashlight or lamp with a low wattage red light bulb. Insects cannot see red and the crickets will think it is dark. Observe any differences in cricket behavior in the light and in the dark.
- Learn how to use insects to make a collection at www.4-H.org/curriculum/entomology.
- You can record your data in the graph paper section below, or download a data page from the 4-H website at www.4-H.org/curriculum/.

Life Skills

ENTOMOLOGY SKILL: Observe cricket behavior and communication.

SCIENCE STANDARD: Communication.

SUCCESS INDICATOR: Describe how insect chirps are affected by temperature.

Talk It Over

SHARE WHAT HAPPENED: What cricket behavior did you see?

APPLY: Can you tell the temperature by counting the number of chirps from a cricket?

GENERALIZE TO YOUR LIFE: Why do you think male crickets communicate differently depending on the weather?

FACT! There are 900 species of crickets.

Activity 16: I Eat Insects

Few people in the United States eat insects and are upset if they find an insect part in their food. But many people in other countries eat insects as part of their daily diet. Some animals eat insects, too. Insects are nutritious and provide a good source of protein, essential vitamins, and minerals.

DO it Insect Eaters

Read the clues and list the insect-eating animal described.

Clue ❶ I wear a fur coat, have claws, and sleep all winter. I love honey and eat insects. What am I?

_____

Clue ❷ I fly at night and find insects to eat by using echoes. Sometimes I live in a belfry. What am I?

_____

Clue ❸ I have scales and fins and love to swim. I eat worms and insects. What am I?

_____

Clue ❹ I hop and live in ponds. What am I?

_____

Clue ❺ You have two legs and I have 100. So which foot do I move first? What am I?

_____

Clue ❻ I have feathers but can't fly very far. I give you eggs for breakfast. What am I?

_____

Clue ❼ I have a long snout and a long tongue to catch ants. What am I?

_____

Clue ❽ I am a plant. Some people think I can play baseball because of my name. Insects fall inside and are caught in a liquid at the bottom. What am I?

_____

Clue ❾ I sat down beside her and Little Miss Muffet ran away. What am I?

_____

WORD BANK

Check off each insect name as you enter it in one of the blanks.

☐ anteater	☐ chicken	☐ fish	☐ bat	☐ spider
☐ millipede	☐ frog	☐ pitcher plant	☐ bear	

Activity 16: I Eat Insects

Insect Facts – Insects People Eat

People in other countries often eat insects as a good source of protein. Some of the insects eaten in selected countries are given in the table below.

Country	Insects
Mexico	Aquatic bug eggs, caterpillars of giant skipper butterflies, ant larvae
Africa	Grasshoppers, termites, caterpillars of giant silkworm moths, weevil larvae and adults, crickets, green shield bugs, black ants, honeypot ants, cicadas, palm rhinoceros beetles
Southeast Asia	Giant water bugs, brown crickets, silkworm pupae, wasp larvae, caddisfly larvae, cicadas, grasshoppers, dragonflies
South America	Leafcutter ants, beetle grubs, palm weevils

Life Skills

ENTOMOLOGY SKILL: Reviewing animals that eat insects.

SCIENCE STANDARD: Behavior of organisms

SUCCESS INDICATOR: List animals that eat insects and insects that some people eat.

Talk It Over

SHARE WHAT HAPPENED: How many animals could you name after reading the clue?

APPLY: Why do some animals eat insects?

GENERALIZE TO YOUR LIFE: Why do different people eat different things?