



REVIEWED & RECOMMENDED
National 4-H Curriculum

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Product Number 08441



Teaming with Insects

Entomology • Level 2 • Grades 6-8



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Note to 4-H Member

Studying and learning about insects is fun. They exist nearly everywhere, so you can study them wherever you live. Insects have been around for millions of years and have adapted to many different habitats. Adaptations (species changes over many generations that allow the species to become better suited to a habitat) can be seen in their legs, eyes, wings, abdomen, and antennae. There are over 1 million known species of insects, and scientists believe there may be 10 to 40 million more to identify. Maybe you'll find one!

Most people consider insects pests, and some insects do damage crops or bite humans and other animals. But most insects are an important part of their ecosystem and a few, such as honey bees and silkworms, provide direct economic benefits. The *Teaming with Insects* curriculum is written for youth who enjoy learning about science and nature.

Level 1 introduces the world of insects. Activities focus on how they look and move and provide some background for studying important entomology topics. Level 2 shows you 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 you to take control of your learning by doing your own research using the scientific method and reference materials. The key to learning with any 4-H project is to enjoy your studies and to learn at your own pace. We hope this project is just the start of a lifetime enjoyment of entomology!

Insect identification is not covered in this book. The following references are recommended for those entomologists who want to learn more about collecting and identifying insects:

- *Arthropod Collection and Identification, Laboratory and Field Techniques*, Timothy J. Gibb and Christian Y. Oseto, Academic Press, www.4-H.org/curriculum/entomology, ISBN 12:978-0-12-369545-1 and 10:0-12-369545-7.
- *How to Make an Awesome Insect Collection, A Beginners Guide to Finding, Collecting, Mounting, Identifying and Displaying Insects*, Timothy J. Gibb and Christian Y. Oseto, Purdue University, available in print (from www.4-H.org/curriculum/entomology) and online at www.4-H.org/curriculum/entomology.

Acknowledgments

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Each activity was developed to be completed in approximately 40-50 minutes. Many can be adapted for a shorter time frame if needed. Some may also take longer, particularly when completing a “Dig Deeper” or using the Scientific Method.

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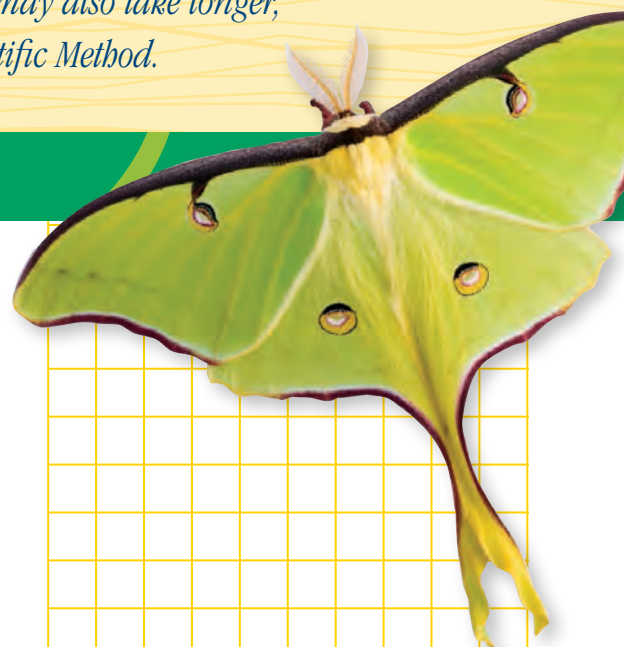
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Date Activity
Completed



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Chapter 1: Be an Entomologist

Entomologists use tools to collect and identify insects and help them understand insect behavior. If you are interested in entomology – the study of insects – there are many tools you can make that will help you collect and observe insects.

Activity 1: Tools of the Trade



*As you use your tools for the **Teaming with Insects** activities, pay attention to the variety of size, shape, and color you see. Insect bodies consist of three sections: the head, thorax, and abdomen. They have six legs attached to the thorax. Most insects have two pairs of wings, but some have only one pair and a few have none at all. Insects usually have two sets of jaws, one of two kinds of eyes (simple or compound), and one pair of antennae. They breathe through holes in their sides called spiracles and do not have lungs. Insects have an exoskeleton, a kind of skeleton on the outside of their bodies.*

MAKE it Aerial Net

A net is needed for collecting many insects, especially butterflies, moths, dragonflies, and other flying insects. In this activity you will be making an aerial net. Another type of net is called a sweep net, which is used in bushes and heavy shrubbery. Aquatic nets are used in the water.

A general purpose net is one that is sturdy enough to sweep plants, yet light enough to be swung quickly through the air. Variations in the basic plan or the materials used are common and can be adjusted to suit your needs. An aerial net consists of a handle fitted on a heavy wire loop to which a bag is fastened.

Tool Kit

- ☐ Two wire coat hangers or other stiff wire
- ☐ Roll of electrical tape
- ☐ Netting, 1 yard. Note: An ideal material for making the bag is nylon mosquito netting, available from surplus stores. A good quality marquisette, tulle, or similar material also can be used, but cotton mosquito netting or cheesecloth is not satisfactory.
- ☐ Iron-on fabric tape
- ☐ Two hose clamps
- ☐ Wire cutter
- ☐ Flat-headed screw driver
- ☐ A 4' to 5' length of 3/4" wood dowel (or an old broom handle)

- Cut off and discard the hooked ends on the two coat hangers and straighten the remaining sections.
- Tape the straightened pieces of wire together and wrap both ends with electrical tape.
- Next, cut two pieces of the material into a triangle that has a base of 18 inches and a height of 28 inches. Seal the sides of the two pieces of material with iron-on fabric tape.
- Fold about 2 inches of the base of the net down and seal it with iron-on fabric tape to make a loop for the wire. There should be enough space to slide the wire through the netting.
- Cover one end of the wire with tape and thread the wire through the loop in the netting.
- Curve the wire (and netting) into a circle and secure it to the dowel with two hose clamps.



Activity 1: Tools of the Trade



Aerial Net

- Swing your net quickly through the air to catch flying insects such as bees, wasps, butterflies, dragonflies, and other insects.
- Try to loop the bag over the hoop of your net when you swing to prevent insects from escaping.



Hand Lens

It is fun to make your own hand lens, but a purchased magnifying glass will also work.

Tool Kit

- ☐ Empty 35-mm film canister (available in a photography store or the photo department in a drugstore). Note: White canisters are preferred because they provide more light but a black or gray canister will work.
 - ☐ Cap from a plastic soft drink bottle that will fit into the film canister
 - ☐ Lens from Carolina Biological Supply Co., Item no. 602294, \$8.75 (2010) for a package of 12 lenses (See www.4-H.org/curriculum/entomology to find website for this resource.)
 - ☐ A 3" long, 3/4" wood dowel (or wooden spoon)
 - ☐ Power drill and 1/2-inch drill bit
- Carefully drill a 1/2-inch hole into the bottom of the canister and another 1/2-inch hole through the cap of the soft drink bottle. Safety Note: Use pliers to hold the cap when drilling. Get help with this step if you are not familiar with using a power drill.
 - Place the lens into the film canister and push in the bottle cap with the top of the cap facing the bottom of the canister.
 - Use the dowel to push the bottle cap all the way to the bottom of the canister so that the lens is held securely in place.



Hand Lens

Use your film canister hand lens to get a closer look at an insect.



Collecting Jar

Carry a collecting jar with you into the field so you can quickly and safely kill insects you collect. Entomologists often call these “killing jars.”

Tool Kit

- ☐ Glass jar with tight fitting lid
- ☐ Piece of corrugated cardboard
- ☐ Masking tape or duct tape
- ☐ Rubber bands
- ☐ Fingernail polish remover
- ☐ Scissors



- Mark around the bottom of the jar on a piece of cardboard and cut out the circle. The cardboard must fit through the mouth of the jar.
- Cut several pieces of rubber band in short strips and place them in the jar.
- Push the cardboard circle into the jar on top of the rubber bands.
- Add a little fingernail polish remover into the jar - just enough to wet the cardboard. The rubber bands will

soak up any excess liquid. Safety Note: Fingernail polish remover must be used carefully since it can damage eyes and lungs and is highly flammable. Be careful when pouring fingernail polish remover into the jar, holding it away from your face and nose so you do not inhale the fumes.

- Close the jar immediately and keep it closed except when placing insects into the jar.
- Wrap the bottom of the jar with tape in case the jar is broken.



Collecting Jar

Add some tissue paper to your collecting jar so that insects do not damage each other. Add more fingernail polish remover if the cardboard has dried out or if the collected insects do not die within a few minutes. Some insects may take longer to die than others. You may want to make a few jars to take when collecting.



Relaxing Jar

Once you have collected your insects, it is important that they are properly relaxed before pinning to avoid damage.

Tool Kit

- ☐ A plastic container about 5 inches by 9 inches with a tight fitting lid (a food storage container works well)
- ☐ Playground sand
- ☐ Styrofoam™ piece, cut slightly smaller than container
- ☐ Bleach

- Pour about an inch of sand into the container and add just enough water to moisten the sand.
- Place the Styrofoam on top of the sand and cover with the lid until you're ready to use.



Relaxing Jar

- Place your dried insect specimens on top of the Styrofoam. Do not add more specimens than you can pin easily within an hour or so.
- Cover the container.
- If you notice mold appearing on the specimens, add one or two drops of bleach or Lysol.® (Do not add too much bleach or some of the specimens might become bleached.)
- Check the specimens for flexibility after two days. If the legs cannot be easily moved, return the specimens into the container for a few more days.
- Once the specimens are relaxed, pin them immediately.

Activity 1: Tools of the Trade

Life Skills

ENTOMOLOGY SKILL: Making the tools needed to study insects.

SCIENCE STANDARD: Science as inquiry, collecting data.

SUCCESS INDICATOR: Collecting specimens with the created tools.

Talk It Over

SHARE WHAT HAPPENED: What was the most difficult part of making the tools? How would you change making the tools so they are easier to create?

APPLY: Which areas allowed you to collect the most insects with your net?

GENERALIZE TO YOUR LIFE: How is your life made easier because of tools? What tool would you change to make it more efficient?



The smallest insect is *Zenillia pullata*, a tachinid fly. Its egg measures 0.0001 by 0.0008 inches.



Chapter 2: Biodiversity

Biodiversity describes variations of animals and plants in a habitat. It is often used to measure the health of biological systems. Insect diversity is seen in the wide variety of shape, form, size, and color that exist. Their relatively small size, high reproductive potential, and diverse feeding habits allow insects to be very successful animals in our world. They live in nearly every habitat and feed on a vast array of foods.

Scientific Classification of Insects (Linnaeus, 1758)

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Mandibulata

Superclass: Hexopoda

Class: Insecta

Activity 2: Measuring Diversity



Entomologists often collect live specimens for observation and experimentation in their laboratories to help them learn more about insects and their behavior.

MAKE it Berlese Funnel

The Berlese funnel (named after Antonio Berlese) will help you collect small insects that you might not find by yourself. Use your hand lens to get a better look.

Tool Kit

- ☐ Two-liter soda bottle
- ☐ Scissors
- ☐ Magic marker
- ☐ 4-inch square piece of wire or plastic window screen
- ☐ Isopropyl alcohol or other preservative
- ☐ Small lamp with a 40-watt bulb

- Draw a circle around the middle of the plastic bottle with a magic marker.
- Use scissors to cut the bottle.
- Cut a circle of screen, slightly smaller than the diameter of the bottle.
- Put the top of the bottle upside down, into the bottom half of the bottle.
- Place the screen in the top part of the bottle.
- Pour about two inches of isopropyl alcohol or other preservative into the bottom of the bottle. (This is optional; you may choose to catch and then release the insects.)



USE it Berlese Funnel

- Go outdoors and collect decaying organic materials such as leaves, grasses, moss, flowers, or small pieces of rotting logs.
- Place a handful of the organic material on the screen.
- Cover the top with plastic wrap to keep insects from escaping. When you return home, put a lamp over the funnel.
- Set it aside until the plant materials have dried. Check the container daily for insects and other organisms that have fallen into the alcohol. View through your hand lens.
- Sample and compare the insects from different types of decaying plant materials such as rotting logs, the soil beneath decaying leaves, and grasses.
- Identify and record the insects you find in different places.

FACT!

When disturbed, burying beetles roll on their backs and buzz like a bumble bee.



Indoor Insect Trap

You can find insects in most homes and buildings, but often you will need to collect them using a trap like the simple one described below.

Tool Kit

- ☐ Plastic cup or the bottom of a water bottle or plastic jar
 - ☐ Petroleum jelly
 - ☐ Sheet of paper
 - ☐ Bait such as an apple slice or piece of banana
 - ☐ Transparent tape
- Make a cone out of the paper and tape it into a funnel shape. Make the small end of the funnel about $\frac{1}{2}$ inch wide.
 - Coat the inside of the container opening with petroleum jelly (so the insects can't crawl out).
 - Put the paper funnel into the neck of the container and secure it with tape.



Indoor Insect Trap

- Put pieces of fruit in the container to attract insects.
- Place your insect trap sideways on the floor.
- Tape the funnel to the floor so that insects can walk on the funnel and into the container.
- Make a table to record your data (see example).
- Identify and record the insects you find in different places.

Insect Collection Data

Trap Number	Trap Location	Date Trap Filled	Insects Collected

Life Skills

ENTOMOLOGY SKILL: Making and using a Berlese Funnel and Indoor Insect Trap.

SCIENCE STANDARD: Insect structure and function.

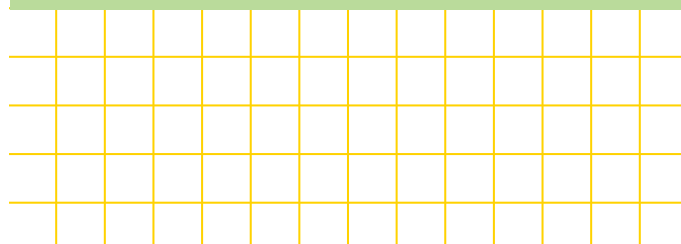
SUCCESS INDICATOR: Collecting insects (and their relatives) from various habitats.

Talk It Over

SHARE WHAT HAPPENED: How many different places did you choose to collect samples?

APPLY: Why is it important to know what organisms are found in the soil and indoors?

GENERALIZE TO YOUR LIFE: How do insects in the soil help us to grow plants? How do these insects cause damage to plants? How might indoor insects be controlled?



Activity 3: You Are My Light



The order Lepidoptera contains moths, butterflies, and a third group of which most people are unaware, the skippers. Follow the instructions below to use their attraction to light to collect Lepidoptera.

MAKE it Modified Wilkinson Trap Tool Kit

The original Wilkinson Trap (named after Ronald S. Wilkinson) was originally described as a blacklight box trap for nocturnal insects. You'll build one that uses a flashlight instead.

- ☐ Flashlight
- ☐ Cardboard box about 1 foot x 1 foot x 1 ½ foot
- ☐ Duct tape
- ☐ Empty toilet paper rolls (4-5)
- ☐ Scissors or knife (Use carefully!)
- Cut off the short end-flaps on the top of the box.
- Push down the long flaps on the top until there is about a 2-inch gap between the flaps (see photo).
- Tape the flaps into position to maintain the 2-inch gap between the flaps. You have now made a modified Wilkinson Trap.



USE it Modified Wilkinson Trap

- Lay the box on its side with the opening you created parallel to the ground. Open the opposite end (originally the bottom) and tape some of the toilet paper rolls on the two upright sides to allow a place for moths to hide. Tape the flashlight to one of the sides also so that, when on, the light is shining up. Close the back of the box with a piece of tape that has one end folded over so you can open it again.
- Place your trap outside about ½ hour before the sun sets. Choose a place as far from other light sources as possible.
- Open the back of the box to turn on the flashlight. Re-close it with the tape.
- Check your trap when sun starts to set and check again in 2 to 3 hours.
- Create a table to keep collection data. Include the date, time you checked your box, temperature, moon phase, wind conditions, number of moths collected, and any other insects collected.
- Use the chart to determine what butterflies, moths and skippers you collected.
- You can identify the insects you catch by using one of the recommended resources.

CHARACTERISTIC	MOTH	SKIPPER	BUTTERFLY
Body	Wide	Wide	Slender
Antennae	Feather-like	Hooked at tip	Knobbed at tip
Wings at rest	Away from body	Over body	Over body
When active	Night	Day	Day
Picture	