REVIEWED & RECOMMENDED
National 4-H Curriculum

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Product Number 08442

Teaming with Insects

Entomology • Level 3 • Grades 9-12

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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.

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.extension.purdue.edu/new) 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.

Table of Contents

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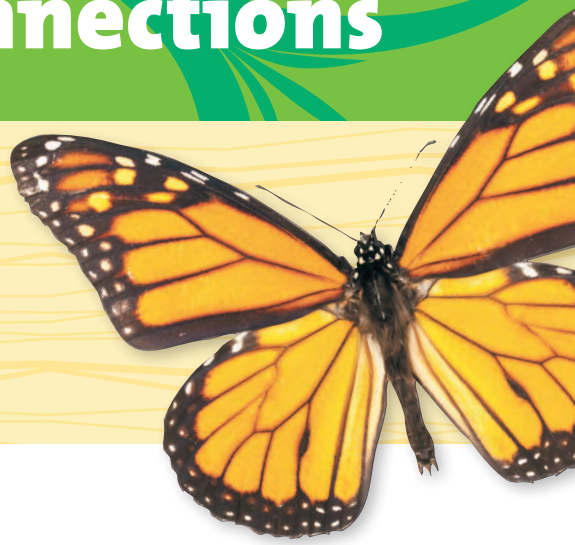
Chapter 1: Be an Entomologist

If you are interested in entomology – the study of insects – you might enjoy a career where you can use your entomology knowledge. There are many careers that benefit from an understanding of insect behavior and the ability to identify insects, and many require you to be able to research and present information about the people and environment affected by insect populations. Entomologists use the scientific method to organize their approach to investigating insect behavior.

Activity 1: Career Connections

It is never too early to start investigating career alternatives. These activities help you explore careers requiring a knowledge of insects, look into opportunities for interviewing and spending time with an entomologist now, and set some goals for the future.



DO it Expore Entomology

Choose one or more of the following options to explore careers in entomology.

- Study the local paper and phone book and list all the businesses that work both directly and indirectly with insects. Title your list, Entomology Careers.
- Visit the Entomological Society of America (ESA) website (www.4-H.org/curriculum/entomology) and search for information about careers in entomology.
- Interview an entomologist. Find out what they do and keep notes in a journal. You might ask them to help you develop your entomology career list.
- Ask an entomologist if you can spend a workday with them. Find a day that fits both of your schedules—one that provides the best opportunity to learn the type of work they do. Take a journal for notes and a camera to take pictures of your work day and the entomologist who is helping you.
- List the type of job you would like to have at the following points in your life. Make notes on what type of education, training, and work experiences will help you achieve your goals for your:
  - … first job out of college.
  - … job when you are 30 years old.
  - … job when you are 50 years old.

Life Skills

ENTOMOLOGY SKILL: An awareness of entomology careers.

SCIENCE STANDARD: Science as inquiry, science in personal and social perspectives, history and the nature of science.

SUCCESS INDICATOR: Demonstrate an understanding of careers in entomology and personal career goals.

Talk It Over

SHARE WHAT HAPPENED: What did you learn about entomology careers?

APPLY: How can planning help you achieve your career goals?

GENERALIZE TO YOUR LIFE: How can planning help you achieve your personal goals?

Activity 2: State Your Insect

What is your state tree? Do you know your state flower? How do they represent your state? Does your state have a state insect?

MAKE it Brochure

Tool Kit

☐ Access to the Internet or library. Find your state tree, flower, and any similarly designated state item. List what you find and how they represent your state and its history.

- Use your knowledge of insects to select a state insect, even if your state already has one. Consider color, size, habitat, and beneficial traits.
- Design a brochure that promotes your choice. Title your brochure, Proposal for a State Insect. Include the insect's common name, scientific name, a drawing or photograph, and why the insect should be adopted as your state insect. Be creative!

Dig Deeper

If your state does not have a state insect, you can nominate one! Contact your local legislator to see what needs to be done to promote your insect.

Life Skills

ENTOMOLOGY SKILL: Finding relevant information on insects and relating the information to the history of the state or to beneficial traits of the proposed insect.

SCIENCE STANDARD: Science as a human endeavor.

SUCCESS INDICATOR: Selecting a state insect.

Talk It Over

SHARE WHAT HAPPENED: Why did you choose the insect you did for your state insect?

APPLY: Why do states have state trees and flowers?

GENERALIZE TO YOUR LIFE: What other natural resources are used to represent people or companies?

FACT! The most dangerous insect is the Anopheles mosquito because it transmits the parasite that causes malaria. Malaria kills more than a million people each year.

Activity 3: The Scientific Method

The scientific method gives researchers an organized way to investigate answers to problems and curiosities. There are five steps to the scientific method.

1. Stating the Problem
Describe what you want to learn.

2. Forming the Hypothesis
Create a statement suggesting a possible answer to your problem.

3. Observing and Experimenting
Make observations or set up an experiment to test your hypothesis. Tally your data.

4. Interpreting Data
The data you collect can be interpreted by comparing numbers visually or in graphic form.

5. Drawing Conclusions
Is the hypothesis supported by observations and experiments? If so, we say that the hypothesis is "proved." If not, it is "disproved." What ideas do the results give you for future studies?

DO it Using the Scientific Method

Tool Kit

☐ Entomology Level 2 activity book and records (optional)

Use the scientific method to solve one of the problems listed below.

- At what time (in ½-hour increments) are May (or June) beetles most active in your area? Set up your own experiment.
- In what habitat (forest, field, garden, or lawn) can you catch the most insects in ½-hour?
- How many insects can you collect in ½ hour, using one of the traps you made in Level 2? (Entomology 2, Activities 2, 3, 8, 13)
- At what time (in ½-hour increments) can you catch the most moths with sugaring? (Entomology 2, Activity 4)

Life Skills

ENTOMOLOGY SKILL: Learning about insects in and around your home.

SCIENCE STANDARD: Using the scientific method to solve a problem.

SUCCESS INDICATOR: Completing the five steps of the scientific method.

Talk It Over

SHARE WHAT HAPPENED: Which problem did you decide to solve and why?

APPLY: What insect problem or question would you like to study? How would you apply the scientific method to answer your question?

GENERALIZE TO YOUR LIFE: Adapt the scientific method to help you decide what college you would like to attend.

2

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 become very successful animals in our world. They have not only developed ways to live in nearly every habitat, but have also developed the ability to feed on a vast array of foods.

Scientific Classification of Insects (Linnaeus, 1758)

Kingdom: Animalia

Phylum: Arthropoda

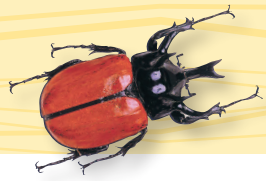
Subphylum: Mandibulata

Superclass: Hexopoda

Class: Insecta

Activity 4: Observing Arthropods

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



MAKE it Observation Station

Tool Kit

- ☐ Soda bottle, 2-liter, rinsed
- ☐ Scissors
- ☐ Sand or soil
- ☐ Small piece of damp sponge
- ☐ Panty hose or cheesecloth
- ☐ Rubber band
- ☐ Plant mister

- Remove the top of the soda bottle (cut in a straight line about 1/3 of the way down).
- Fill the bottom of the bottle with some sand or soil.
- Cover the mouth of the bottle top (the piece you cut off earlier and set aside) with a piece of panty hose or cheesecloth and secure it with a rubber band.
- Invert the top and place it in the bottom of the container. (Your observation station will be similar to the Berlese Funnel made in Level 2.)

DO it Observation Station

- Write a problem statement and hypothesis comparing ants to sowbugs (or pill bugs).
- Place twigs, vegetation, and a tiny bit of sponge inside the bottle and mist lightly with water.
- Collect five ants and five sowbugs (or pill bugs).
- Place the animals in your observation station.
- Watch the animals for 30 minutes and keep notes listing everything that you see them do. Keep separate lists for the ants and sowbugs.
- Observational data does not generally lend itself to data analysis with charts, tables, and graphs. Instead, analysis is generally qualitative (study of behavior and preferences), rather than quantitative (measurable). Read through all your observations about ant behavior and make one or two general statements about them. Then do the same for the sowbugs.
- Compare your statements and draw conclusions about the behavior of ants and sowbugs.
- Did you prove or disprove your hypothesis?
- What future questions could be explored?

Life Skills

ENTOMOLOGY SKILL: Collecting and observing insects and arthropods.

SCIENCE STANDARD: Observation and evaluation skills.

SUCCESS INDICATOR: Youth can accurately describe the behavioral differences between ants and pillbugs

Talk It Over

SHARE WHAT HAPPENED: What did you notice about the behavior of ants and sowbugs?

APPLY: Did you learn anything about ants that would help you keep them out of your house?

GENERALIZE TO YOUR LIFE: How could you use a playground as an observation station?