

Catch the Bug

Unit 1



Adapted from the *4-H Entomology Member's Guide* prepared by the National 4-H Entomology Program Development Committee.

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Thank you for volunteering to teach this entomology unit. Insects are wonderful teaching tools and provide children with exciting subjects to work with. If you have never worked with insects before, don't worry. This manual is organized for you to use without problems. Prepare yourself to enter the wonderful world of insects. See your members' faces light up with enthusiasm when they study these interesting creatures.

What is 4-H?

4-H is an educational program designed to develop attitudes, values, and skills that help make young people productive members of society. "4-H" stands for head, heart, hands, and health and corresponds with educational, moral, work, and health ethics. Specific goals of the organization supported in the project are for youth to develop:

- a concern for society and the world at large
- an understanding of science and appreciation for nature
- consumer skills
- life skills, including:
 - creative use of leisure time
 - leadership
 - attitudes and skills important in a career
 - communication skills
 - a sense of responsibility
 - desirable interpersonal relationships
 - responsible citizenship

The 4-H meeting

The 4-H meeting is the central activity of the 4-H program. What happens at meetings influences the success of the local program and what an individual learns. The first meeting is very important, because it will affect how much you and your members enjoy 4-H.

The first meeting should be fun and should emphasize getting acquainted. Games and refreshments will help you accomplish this purpose. You might arrange for some of your older members or teen leaders to tell new members about 4-H. Parents and former 4-H members might be invited to help newcomers become part of the 4-H program.

After members and parents have a chance to become acquainted with each other and with 4-H, you can organize the club by:

- electing officers and making program assignments
- selecting a committee of members, parents, and teen and adult leaders to plan the year's program
- discussing what members want to do during the year
- distributing and discussing possible projects

For more information on program planning and organizing, see *The ABC's of Planning Your 4-H Club Programs* and the *Pennsylvania 4-H Leaders Program Planning Workbook*, available from your county extension office.

What is expected of you as a 4-H leader?

To fulfill the objectives of a 4-H program, it is important to understand children's basic needs, which must be met if they are to progress to adulthood in a healthy manner. Youth need to:

- develop a satisfactory self-concept
- have adventures
- experience a sense of achievement
- be accepted by peers and adults
- become independent

As a leader, you can keep members interested by allowing them to help plan and conduct events in the community. 4-H members gain leadership and group skills by helping to make and carry out plans. Here are some ideas:

Family involvement: A kick-off party for present and prospective members and their parents generates enthusiasm for the new year. Parents' events can take the form of an evening program presented by members, a potluck supper with a short 4-H program, or a summer family picnic.

Tours and field trips: Tours and field trips can be educational as well as recreational. They help members put instructional knowledge into real-life situations. Field trips also help them realize that what they are learning is worthwhile because it can be used outside of 4-H. Field trips can be applied to almost any 4-H project you choose. Each project guide may suggest field trips that are applicable to the project you have chosen. For this project, please refer to it the "Before the first meeting" section on page 4 for information on Pennsylvania insect collection laws.

Demonstrations: A demonstration meeting at the local level is good preparation for a similar countywide event. Have 4-H'ers give demonstrations to community organizations such as parent-teacher groups and service organizations, and at nursing facilities and retirement communities.

Decision-making and judging: Judging begins by making choices between two or more things and knowing the reasons for these choices. It is a way of learning to make decisions based on standards of quality. You can teach these standards by providing opportunities to choose and compare products and discuss a product's strong and weak points.

Discussion and problem-solving: Discussions can be an effective way for youngsters to teach themselves different subjects, to gain experience in presenting their views before a group, and to learn the art of perceptive listening. You can stimulate thinking and problem-solving abilities through many of the hands-on activities. Posing questions can be useful in generating discussions.

Exhibits: Exhibits used at local events for parents and friends are a good way to show recognition of 4-H'ers and to promote the 4-H program. The "Pennsylvania State Farm Show Premium List" has suggested standards for Round-up insect collections for first-through fourth-year members. Requirements vary according to county standards. Please contact your county extension office for this information. Our suggested format for county "Round-up" insect collections is as follows:

Member year	Insects collected	Orders represented
1	25	5
2	50	9
3	75	12
4	100	15

All insect specimens should be properly mounted and labeled.

Second- through fourth-year members should have the flexibility to produce "creative collections." Such collections may be insects from the only one order, all aquatic insects, or even all nocturnal insects. These arrangements can be made between the leader and member at the on-set of the project.

Community service: Community service is an integral part of 4-H. In serving others, youth will practice leadership and communication skills and will develop a commitment to the community and its needs. Sharing encourages family involvement and helps youth gain a sense of belonging in the community. Consult your telephone directory's guide to human services for listings of agencies and centers that might appreciate your group's contribution.

Organize a presentation to be given at a health-care facility or to a senior citizen's group. Make an audiotape for those whose sight is impaired. (Contact the Pennsylvania Association for the Blind.) Identify other ways youngsters might be helpful to the community.

What is your role in this 4-H entomology project?

- You should guide your members, but not stifle their creativity.
- You should be prepared ahead of time with all materials for an activity.
- You should keep all your equipment in a box and bring it to each meeting in case there is a need to explain or review material covered in earlier meetings.
- If the weather is bad on the day or evening of an outside event, you should be prepared with an alternative plan.
- You should explain the significance of each topic and how it fits into the whole project.

- You should stress competition within oneself, not with each other. Encourage your members to do their best and strive to better themselves. Explain that each member is unique and has his or her own way of being creative.

The 4-H entomology project is designed so that members of all ages can participate. Certain activities can be conducted over several years. For example, next year you can collect different insects, collect in different habitats, pick a certain order of insects to collect, or do a collection on beneficial insects or pests. Some suggested collection activities for second-, third- and fourth-year members can be found in the Appendix on page 17.

Keep in mind that insects are found everywhere. Although they may be more abundant in a rural area, insects are also found in urban areas. To get a diversity of insects, those in urban areas may want to schedule a field trip.

Activities presented in this book are to be used as guides. Keep in mind that the entomology project fits into many other 4-H projects.

How to use this guide

This guide is designed to take you step by step through each activity. A brief summary will introduce you to each of the topics that are covered in the Member's Guide. It is assumed that the leader has already read the lessons in the Member's Guide. This is critical to understanding the needs of each member. The two guides follow each other very closely. The materials needed and the purpose of each activity are specified at the beginning of each exercise. You should read through the whole guide so that you have a complete understanding of the project. Before each meeting, you need to refer to the "Looking ahead" section at the end of each unit to prepare for the next gathering.

Meeting activities outlined in this guide can be followed strictly or can be varied, depending on the needs of the members. Because of time restraints, it may be necessary to carry over some projects to the next meeting or even combine two meetings into one. As the project leader, you decide how you want the project to be carried out, but you should do this before you begin.

Your guide has a section in the back on various collecting activities. These can provide ideas for collecting certain insects, or members may want to choose an activity to do for a special collection. Make copies of the activities from which they can choose.

Resources

The following is a list of entomological and biological supply companies:

BioQuip Products

17803 LaSalle Ave.
Gardena, CA 90248-3602
(310) 324-0620

Carolina Biological Supply Co.

2700 York Rd.
Burlington, NC 27215
1-800-34-5551

Powell Laboratories Division

Gladstone, OR 97027
1-800-334-5551

Entomological Supplies, Inc.

5655 Oregon Ave.
Baltimore, MD 21227

Insect Lore

PO Box 1535
Shafter, CA 93263
1-800-Live Bug

Nasco • Fort Atkinson

901 Janesville Ave.
PO Box 901
Fort Atkinson, WI 53538-0901
1-800-558-9595

Ward's Natural Science Establishment, Inc.

PO Box 1712
Rochester, NY 14603
1-800-962-2660

Resources (continued)

The following is a list of entomology guides and estimated prices that can be used in collecting: (These or similar guides should be available at your local library.)

Peterson Field Guide to the Insects, by D. J. Borror and R. E. White, \$5.95.

The Audubon Society Field Guide to North American Insects, \$18.95.

Peterson First Guide to Insects, by C. Leahy, \$4.95.

Butterflies and Moths, by R. T. Mitchell and H. S. Zim, (Golden Guide Series), \$5.95.

Insect Pests, by G. S. Fichter, (Golden Guide Series), \$4.95.

Insects, by H. S. Zim and C. Cottam, (Golden Guide Series), \$5.95

Picture Key Nature Series, W. C. Brown Communications, Inc. Prices may vary from \$15.00 to \$20.00

How to Know the Aquatic Insects, by Lehmkuhl

How to Know the Beetles, by Arnett, Downie, and Jacques

How to Know the Butterflies, by Ehrlich

How to Know the Insects, by Bland and Jacques

How to Know the True Bugs, by Slater and Baranowski

How to Know the Immature Insects, by Chu

For the leader:

An Introduction to the Study of Insects, by Borror, Triplehorn, and Johnson, \$50.00.

Before you get started

1. Read through both the Member's Guide and the Leader's Guide.
2. Order insect pins from a supply company. (See the "Resources" section on page 3.)
3. Order ethyl acetate or purchase fingernail polish remover for the killing jars.
4. Start collecting empty mayonnaise and jelly jars.
5. Plan to schedule a guest speaker for Meeting 4. Contact a university entomology department, the Penn State Cooperative Extension office in your county, or a pest control service. Be creative and use the community to enhance your program.

Before the first meeting

1. Look at a calendar and choose a tentative date and place for the field trip (Meeting 5). Choose a Saturday or Sunday when almost everyone can get together during the morning or afternoon hours. Members can bring lunches, and their parents too. Ideal spots for field trips include grassy parks, meadows, or fields of flowers or tall grasses.

There are several collection laws that you will need to follow. In Pennsylvania, you are NOT allowed to collect at state or national parks without permits. You CANNOT transport live insects over state or international lines. You can only collect aquatic insects if you are over 16 and have a fishing license; you also need an educational aquatic field study permit from the Pennsylvania Fish and Boat Commission. Once you obtain these permits, you may only collect a MAXIMUM of 50 aquatic insects. Some states DO NOT allow you to collect at all. Please check with the proper authorities before you take your trip.

2. Find out whether local bookstores have insect guides available, or borrow guides from the library.
3. Purchase from a craft department or store the net material for Meeting 1.
4. Make several copies of the collection activities at the end of this guide.
5. Estimate the cost of the materials for members, such as plaster of paris, ethyl alcohol, and insect pins. Ask your members to bring money for these items to the next meeting.

If the members cannot afford to buy supplies, there are alternative approaches. Killing jars can be made without plaster of paris, and insects can be suffocated in a tightly sealed jar or frozen in a freezer for a day or two. Insects also can be caught by hand instead of with a net, and a pillowcase can be used to collect flying insects. Insect pins should be used for permanent collections because of their resistance to rust, but for temporary collections, straight pins from home can be substituted. If you spend some time brainstorming, you will discover that almost everything has a substitute.

6. During the first meeting, you will demonstrate how to make a collecting net. Have the pieces ready to assemble at the meeting, but stitch the net beforehand. (You are not expected to sew the net in front of the members.) You should feel comfortable showing the group how to put the parts of the net together. Make suggestions based on difficulties you encountered.

Topic introduction

Insects are found everywhere. They invade our homes, sting or bite us, pollinate our food crops, eat our food crops, decay our waste matter, and provide us with beauty. It's unlikely for you to go through a day without seeing some kind of insect in your home, car, or workplace. It is important for children to have an appreciation for insects since they greatly influence our environment. Especially today, with the growing interest in environmental issues, we need to realize that insects affect our environment in several ways: they cause us to use harmful pesticides that may get into the food chain or in groundwater; they carry diseases that kill millions of people every year; and they are food for many animals on the planet. They affect our daily lives. Teaching youth an appreciation for nature may help them respect the environment and make informed decisions as adults.

Studying insects also provides youth with hands-on science experience. Not only will they be collecting and identifying insects, but they will also be making their own equipment used to collect insects. This project will help youth develop pride in their work as they strive to make their collection as neat as possible. (You may want to read the "Welcome to Entomology" section in the Member's Guide.)

Purpose and objectives

The leader should:

- identify common insects important in our lives
- locate resource materials available to study insects
- demonstrate how to make an insect net
- analyze a record-keeping system for the insect collection

Materials needed for this meeting

- index cards
- 4-H member's guides
- examples of the field guides members may buy or check out of the local library
- insect net material (See the Member's Guide.)
- examples of jars used to make a killing jar and a relaxing jar
- crayons, colored pencils, and markers

Procedures

1. Distribute index cards and extra pencils to the members and ask them to write their name, parents name(s), address, and telephone number on the card. You can use these cards if you ever need to contact members or parents.
2. Have members introduce themselves and tell the group what their favorite insect is and why. You may even want to have "bug" nicknames for the members. (This exercise will help to get everyone comfortable with each other and comfortable with speaking in front of a group.)
3. Play a game in a round. Gather everyone in a circle and start the game by saying, "I went insect collecting and I caught a (choice of insect, e.g., firefly)." Then the next person says, "I went insect collecting and I caught a firefly and a (choice of insect)." Each person repeats the choices made before in the correct order and adds his or her own. The list grows longer and longer. Anyone who confuses the order or forgets an insect must sit out. To make the game longer, you may let members "pass" or "skip" one turn if they get stuck. Continue playing until only one person is left and he or she can repeat the whole list back. (This exercise will help youth interact with one another, help to develop their memory skills, and also get them to think about how many kinds of insects there are.) Tell them there are between 750,000 and 1,000,000 known insects in the world.
4. Show the group examples of insect field guides they can choose to buy or borrow from a library. Point out the section in the Leader's Guide that has a listing of insect guides available at stores or libraries and let them know where you were able to locate them.
5. Pass out a Member's Guide to each participant. Begin familiarizing members with their guides by asking for volunteers to read the introduction and table of contents. Have the members look through their guides to get them interested. Show them the record-keeping page. Explain how important it is to record where and when they found their insects, because they will be using this information to label insects in their collections. Since records provide information on where to find an insect and what the insect looks like, they are a useful tool to use if you ever need to collect that insect again. Show them that in Meeting 8 they will learn how to attract insects by making their own traps. Also, show them the page on Entomological Societies to join, and point out the Glossary. Tell them they can color in all of the illustrations, including those in the identification key.

6. Discuss the field trip and ask them if the date and time you have in mind for the trip is suitable for them. Have them ask their parents and report back next time. Also, have them ask their parents if they can help drive to the site you have chosen.
7. Have them draw in the pictures for the "Where To Look for Insects" section of their guides. Ask them if they know of any other areas where insects can be found. Begin a discussion as you pass out the crayons, pencils, and markers.
8. Explain that they are going to be making much of their equipment and are responsible for bringing in materials needed for the projects. Demonstrate how to make an insect net. Tell them to follow the pattern in the guide and to make one at home and bring it to the next meeting.
9. Tell them to read the Meeting 2 chapter and complete the exercises for the next time.
10. Tell them to ask their parents to save empty glass jars or get them from recycling bins.
11. Tell them to bring in a jar next time for making a killing jar. Explain that the mouth of the jar should be the same size as the bottom. (They will be cutting cardboard to put in the bottom and it has to fit through the mouth of the jar to cover the bottom.) Show them some examples. Have them read the section on how to make a killing jar before the next meeting.

Looking ahead

You will want to read the Meeting 2 chapter in the Member's Guide and prepare to discuss new terms, parts of an insect, and scientific classification. A poster board or chalkboard can be used to draw and review the parts of an insect.

Since you will be making killing jars at the next meeting, purchase plaster of paris from a hardware store for youth to use in their jars. Estimate based on the number of members how much plaster of paris you will need to mix by referring to the directions in the Member's Guide.

At the next meeting, you will be passing out slips of paper with interesting insect facts. Make a copy of the list of facts in the next column and cut each fact into an individual slip.

Interesting insect facts

- Half of the deaths in the world are caused by diseases carried by insects.
- More people in the world die each year from insect-transmitted diseases than from any other cause including heart attacks, accidents, and even cancer.
- Some insect pests actually eat 100 times their body weight each day!
- Insects are responsible for eating about one-third of the food we grow.
- Insects have survived for over 300 million years, since before the dinosaurs existed.
- A flea can jump 100 times its length!
- Ants can actually carry about 50 times their weight with their mouthparts!
- There are some insects that are so small that you need a microscope to see them and others that are so big they reach a foot in length!
- Some insects look just like parts of plants, so they blend in well for protection.
- Some insects have spikes or spines that help them fight off enemies.
- Some insects have what looks like big eyes on their wings or have markings on their bodies to make them seem bigger than they really are.
- Scientists believe there are about 1 million species of insects already discovered in the world and between 10 and 30 million that have not yet been discovered.
- Mayflies have no mouthparts as adults because they live for only a day or two.
- Some female fireflies have no wings and are called "glowworms."
- Some aphids are born alive just like humans!
- Crickets make a chirping sound by rubbing their wings together.
- There are more kinds of insects on earth than other living things.
- Insects pollinate our food crops, decay waste matter, and supply us with products such as wax, honey, and silk.
- Insects live in air, in water, on plants, under rocks, in soil, and just about everywhere you look.
- Some insects, like stink bugs, give off a foul-smelling odor when attacked.
- The bombardier beetle can spray a boiling hot chemical cloud onto attackers.

Topic introduction

Carlos Linnaeus has been credited with developing the classification system for all organisms. Insects fit into a classification system based on certain characteristics. They all have an exoskeleton, three body regions, six legs, and two antennae. Insects are related to spiders, millipedes, centipedes, and crustaceans. Insects are in their own class, Insecta.

Killing jars are used to kill insects for a collection. Ethyl acetate is the chemical used to accomplish this task. Nail polish remover also can be used. Fumes from the agent are toxic to insects. Pouring the agent into the dried plaster of paris is called “charging” the jar. It is important to place a cardboard cutout on top of the plaster so the insect does not come into direct contact with it.

Collecting insects can be challenging, especially when you are trying not to tear the wings of a butterfly or to get stung by a wasp that you are trying to transfer from a net into a killing jar. A detailed description of the collecting process is provided in the Meeting 2 section of the Member’s Guide.

Purpose and objectives

Members should:

- be able to identify major parts of an insect and the kingdom, phylum, and class of insects
- learn several new and interesting facts about insects
- discuss some of the places insects can be found
- learn and practice the proper way of using a collecting net
- demonstrate the proper use of an insect killing jar

Materials needed for this meeting

- plaster of paris for everyone
- bowls or cups with spoons if you let students mix their own plaster
- cardboard and scissors
- jar for you to demonstrate
- extra jars for those who forget to bring one
- net
- construction paper
- poster board or chalkboard for labeling a giant insect

Procedures

1. Distribute slips of paper with interesting facts about insects. Have each student stand up and read the fact out loud. (This will enable the youth to discuss how interesting insects are and also let them speak in front of a group.)
2. Ask questions relating to what the members read for Meeting 2. Ask them to not look at their answers and try to remember the parts of an insect. Have some kind of board on which members can draw and label the parts of a big insect. Give them the correct answers by going over each of the questions out loud.

Testing your memory

1. Can you remember the five kingdoms of creatures?

animals

plants

fungi

bacteria

protozoa

2. What kingdom are insects in?

animal

3. What are animals with backbones called?

vertebrates

4. What are animals without backbones called?

invertebrates

5. Insects are (circle one):

vertebrates

invertebrates

6. List the creatures in each class of arthropods.

Arachnida: spiders,
ticks, mites, scorpions

Chilopoda: centipedes

Diplopoda: millipedes

Crustacea: crabs, shrimp, crayfish

Hexapoda: insects

7. Can you name three of the four characteristics that all insects have in common?

1. exoskeleton
2. 3 body parts
3. 3 pairs of legs
4. 1 pair of antennae

8. What is an **exoskeleton**? hard covering
on the outside of
the insect's body

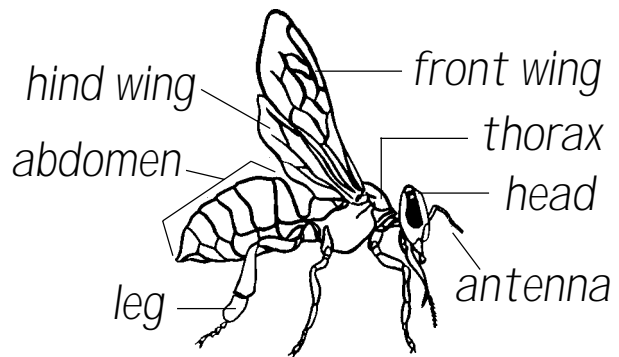
9. What is **chitin**? the material of
the exoskeleton

10. What are **antennae**? organs of touch,
smell, taste, hearing
found on the front of
the insect's head

11. What is a **thorax**? the middle segment
of an insect's body where the legs
and wings are attached

12. Can you label the parts of this insect?

Use the terms **head, thorax, abdomen, antennae, front wing, hind wing, leg**.



3. Have members obtain their nets and review the section on how to collect insects. (See the Member's Guide.) Have them make an imitation insect by crumpling up a piece of colored paper. Don't waste time making the paper "insects" realistic because they will be used only to practice collecting insects with a net. Go through the instructions on how to use the collecting net.
4. Demonstrate how to make a killing jar using plaster of paris. Following the instructions in the Member's Guide, take the members step by step through the process. Tell them to let the plaster in the jars dry for a few days. Explain how to charge the jar with ethyl acetate or fingernail polish remover once the plaster is dry.
5. Assign readings and exercises to be completed for Meeting 3.
6. Tell members to bring the following materials to the next meeting:
 - a. relaxing chamber materials (See the Member's Guide.)
 - b. pinning block materials (See the Member's Guide.)
 - c. dead insects, including two moths or butterflies caught using a net and killing jar

Looking ahead

Review the chapter on Meeting 3 in the Member's Guide and prepare to discuss it next time. Bring in materials to make a relaxing chamber and a pinning block. Practice making both of these before the next meeting. Since you will be showing members how to pin insects in certain areas of the body and how to use a pinning block, you will need to bring in several insects from different insect orders to use in the demonstration. You will also need to pass out pins to each member.

Topic introduction

Each insect is grouped into categories according to certain characteristics, such as mouthparts, wings, and metamorphosis. There are three different types of metamorphosis.

Relaxing chambers are used to relax the joints of insects when they become too stiff to pin. There are rules on where a pin should be placed in an insect's body. Pinning blocks are used to properly place the height of the insect and the labels at equal distances. Small insects that are too small to be pinned directly should be placed on a cardpoint. The Member's Guide explains these concepts in greater detail.

Purpose and objectives

Members should:

- be able to distinguish types of metamorphosis, mouthparts, and wings
- make a relaxing chamber and pinning block
- demonstrate proper pinning techniques for different insects

Materials needed for this meeting

- jar
- paper towels
- water
- pinning block material: cardboard or wood
- glue
- pins
- insects to pin
- Styrofoam

Procedures

1. Going around the room, have the members say something they have learned about insects.
2. Review the reading and the "Wings, mouthparts, metamorphosis review" exercise for Meeting 3.

Try to fill in the blanks without looking back at what you just read.

1. Can you describe three different kinds of insect wings?

scales on wings

membranous wings

hard or shell-like wings

2. Can you name the different kinds of mouthparts insects have?

chewing

piercing-sucking

siphoning

sponge-like

none

3. Read the sentences describing a type of metamorphosis and circle the correct answer.

- a. The insect starts as an egg. A nymph hatches from the egg and sheds its skin many times. It develops wings and becomes an adult. What type of metamorphosis is this?

simple

incomplete

complete

- b. The insect starts as an egg. It hatches into a larva. The larva eats a lot of food and then changes into a pupa. The pupa remains quiet until the adult emerges. What type of metamorphosis is this?

simple

incomplete

complete

- c. The insect starts as an egg. It looks just like the adult only smaller. It sheds its skin a few times and each time gets bigger, but never changes its form. What type of metamorphosis is this?

simple

incomplete

complete

4. Match the following terms on the left to the correct definitions on the right by filling in the letter of each definition in the blank next to the terms.

<u>A</u> membranous	A. Clear wings with veins showing through
<u>G</u> nymph	B. Worm-like or caterpillar stage of insect after hatching from egg
<u>F</u> molting	C. The process of changing form in the insect from egg to adult
<u>E</u> pupa	D. Tube-like mouthparts that take up food as in butterflies and moths called a proboscis
<u>C</u> metamorphosis	E. The quiet stage of an insect before it becomes an adult
<u>D</u> siphoning	F. The process of shedding its skin to grow bigger
<u>B</u> larva	G. The term for an insect stage without wings that hatched from an egg

3. Make a relaxing chamber. (See the Member's Guide.)
4. Take the insects the members brought in and show where to pin certain insects. (See the Member's Guide.)
5. Demonstrate how to make a pinning block. (See the Member's Guide.) Provide insect pins to each student. These pins, unlike straight pins, do not rust. They are made for mounting and pinning insects. Show members the "Resources" section in the "Introduction" to this guide in case they would like to order more pins. Explain how the pins are used and why they should try to conserve them. Then use the pinning block to determine the height of the insects they just pinned.
6. Assign readings and exercises for Meeting 4.
7. Tell members to bring in materials to make a spreading board and insects to spread, especially one or two butterflies or moths. Remind them to bring their new pinning blocks to the next meeting.

Looking ahead

Read the chapter on Meeting 4 and prepare to discuss the information presented and to provide answers to the questions in the exercises. Bring in material for a spreading board and insects to be spread. Get several extra moths in case some members do not have any. Practice mounting insects before the next meeting so that you will be able to teach this activity to the group. You will also want to arrange to have a guest speaker or plan to borrow or rent a video to show at the next meeting. Videos are available from libraries, video stores, universities, or cooperative extension offices. You will need to arrange for the proper audiovisual equipment if you plan to show a video. If you have a guest speaker, choose one that has some experience with entomology.

Topic introduction

Since this is an introductory field collection, you will be collecting common insects that are large enough to mount and observe. The insects covered in Meeting 4 are the most common orders. Examples are given of common individuals found in each order, illustrations of these insects, meanings of their scientific names, descriptions of their characteristics, and some interesting facts about the order. Answers to the exercise were taken from the list of insects provided under the order name.

You will also be teaching members how to mount insects for their collections. Mounting is important to make insects look realistic in a collection. Mounted insects are more appealing and easier to identify. Compare a specimen that looks realistic to a crumpled broken one in a collection. Ask the members which they prefer.

Purpose and objectives

Members should:

- discuss the major differences in the insect orders
- identify insects that represent the different insect orders
- construct a spreading board
- demonstrate proper techniques for spreading insects
- demonstrate proper techniques for spreading butterflies and moths

Materials needed for this meeting

- spreading board
- pins
- insects
- a guest speaker or a video and equipment to play it

Procedures

1. Start a discussion by asking members, "If you could be any insect, which one would you be and why?" Ask how long they think their insects could survive and discuss the forces against them, such as natural enemies and pesticides. Which ones would be killed or eaten first? Which insects would survive the longest?
2. Give answers to the exercise "Matching insects to their order."

Matching insects to their order

Match each insect listed to the correct order. All the blanks should be filled in when you are done.

BLATTARIA	<u>E</u>	A. ant	B. butterfly
COLEOPTERA	<u>Q</u>	C. chinch bug	D. cicada
DIPTERA	<u>K, N</u>	E. cockroach	F. cricket
HEMIPTERA	<u>C, L</u>	G. damselfly	H. dragonfly
HOMOPTERA	<u>D, M</u>	I. grasshopper	J. honey bee
HYMENOPTERA	<u>A, J, R</u>	K. house fly	L. lace bug
LEPIDOPTERA	<u>B, O</u>	M. leafhopper	N. mosquito
MANTODEA	<u>P</u>	O. moth	P. praying mantid
ODONATA	<u>G, H</u>	Q. stag beetle	
ORTHOPTERA	<u>F, I</u>	R. walkingstick	S. wasp
PHASMIDA	<u>S</u>		

3. Make a spreading board. (See the Member's Guide.)
4. Learn and practice how to properly spread the insects that members brought in by using pins to position the legs, wings, and antennae. (See the Member's Guide.)
5. Tell the members to read ahead and prepare for Meeting 6 in case the field trip is postponed because of rain.
6. Introduce the guest speaker or watch the video.
7. Remind members about the field trip planned for the next meeting. They should bring their record books, their pocket guides, and all of the materials made in class. Ask them to wear appropriate clothing for the weather.

Looking ahead

The field trip is scheduled for the next meeting. Plan on covering the material scheduled for Meeting 6 in case it rains and you have to reschedule the collecting trip for the following week. Make sure parents can transport members to the site. Have equipment and guides handy for members to use.

Topic introduction

Members enjoy being outdoors and what better way to teach members about collecting insects than by going out and actually doing it. Stress the use of proper collecting techniques and prepare to help members identify their insects and keep good records.

Purpose and objectives

Members should:

- be able to obtain specimens for their collection
- demonstrate skills and use equipment made in class in a hands-on situation
- document their findings in a record book

Materials needed for this meeting

- extra guides for members to use for identifying their insects
- van or means of transporting the entire group

Procedures

1. Travel to the collecting site.
2. Tell the members to bring to the next meeting pinned insects that need labels.
3. Tell them to bring in small insects to pin on card points.
4. Tell them to bring in their pinning blocks.

Looking ahead

Assign a small presentation for each member to give on a chosen insect. Members should use information covered in the Member's Guide, such as the life cycle, body parts, order, habitat, feeding habits, and location. You may want to prepare a handout outlining what is expected, including library research and visuals. Gather the materials needed for making labels.

Topic introduction

The reading material for Meeting 6 stresses insect orders that you probably will not find or want to pin because they are too small. Explain to the members that if they do find small insects and would like to pin them, they can use a card point.

A key is a useful tool for identifying specifics. It presents general traits to choose from and branches into choices of more detailed characteristics that finally lead to the correct identification. Some insect keys can be very specific and lead to a particular species of insect. Others, such as the one in the Member's Guide, break insects down into orders. To make the key easier to use, a few rarely encountered insect orders are not included. As a result, some insects will not be accurately identified by this key. The use of additional guides will help members identify their insects.

Labels are used in collections to verify the date, the plant on which the insect was found, and the person who collected the insect. Labels can also include the scientific and common names and the order. Labels are a crucial part of any collection. Without them, the collection is worthless.

Purpose and objectives

Members should:

- be able to identify some of the minor orders of insects
- learn how to use a key
- learn how to construct labels for their collection
- learn how to pin small insects on card points

Materials needed for this meeting

- handout on members' presentations
- scissors
- index cards
- pins
- fine markers or pencils
- pinning blocks
- Elmer's glue
- tweezers

Procedures

1. Discuss the field trip.

Was it worthwhile?

Did anyone find a really interesting insect?

2. Give the answers to the first exercise.

The less common insects

- Which insect builds a house or case around its body as a larva?
 - stonefly
 - caddisfly
 - earwig
 - What insect has no mouthparts as an adult because it only lives as an adult for a day or two?
 - silverfish
 - termite
 - mayfly
 - Which insect was once thought to crawl into a part of your body while you were sleeping?
 - earwig
 - termite
 - flea
 - Which insect might you find in your bathroom?
 - springtail
 - silverfish
 - caddisfly
 - Which insect might be found on your dog or cat?
 - earwig
 - springtail
 - flea
3. Explain how to use the identification key. Have the members look at the key in their Member's Guide and complete the exercise. Tell them the exercise will provide a list of characteristics about the insects they have gathered. They may also find clues that they would find in their record book. They should take each characteristic one at a time and move through the key. When they come to a fork where there are several options, they should choose the one that best describes their insect. For example, they need to ask themselves, does my insect have wings or not? If yes, they need to start with "WINGS" at the top of the key. Then the key asks if the insect has one or two pairs of wings. If the insect has two, then does it have scales, a shell-like covering on its wings, or clear membranous wings, and so on. See the example and exercises.

The best way to understand how a key works is to dive right in and get started. Here is an exercise that will take you step by step through the key to identify an insect by order.

Example:

This insect has:

wings
two pairs
scales

Answer: Lepidoptera

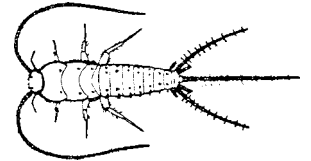
1. This insect has:

no wings
doesn't jump
thick waist
found on animals

Answer: Anoplura

2. This insect has:

no wings
doesn't jump
thick waist



In this situation, since the outcome could be one of three orders, you need to look at the insect shown on the key and compare it to the one you have.

Answer: Thysanura

3. By looking at this picture, see if you can take this insect through the key with the help of these characteristics that you cannot tell from the picture:



found around water
chewing mouthparts

Answer: Odonata

4. This insect has:

two pairs of wings
clear, membranous wings
chewing mouthparts
pinchers at the end of the abdomen

Answer: Dermaptera

5. Refer to the section on labeling insects in the Member's Guide. Cut out labels and ask members what labels are used for and their importance. Practice making some labels using a sharp pencil. Use the pinning block to place labels at appropriate heights.
6. Refer to the section on card pointing small insects in the Member's Guide. Have the members practice cutting out card points and placing insects on them. Make sure they use the pinning block to place card points at appropriate heights. If tweezers are unavailable to bend the tip of the card point down, use fingernails or the edge of a table to form the crease.
7. Assign readings and activities for Meeting 7. Remind members that they may need to use a guide to help them complete the exercise "Finding the Impostors."
8. Bring in equipment to build a collection box.
9. Assign a small presentation (2 to 3 minutes) with illustrations for members to do at Meeting 8 on any insect they choose. Pass out your handout explaining the assignment.

Looking ahead

Prepare some questions that you can ask the members about difficulties they may be having in certain areas of collecting, mounting, etc. Prepare to go over both exercises in Meeting 7. Bring in material for the collection box.

Topic introduction

Scientific names of insects and other creatures follow certain grammatical rules. The first letter of the genus is capitalized, and the species name is lowercased. The whole name is either underlined or italicized. There are also tricks to naming. Not all bugs and flies are actually classified as true bugs or real flies. For example, a house fly is a real fly. It is classified in the order Diptera (true flies). But a firefly is not a real fly. It is in the order Coleoptera (beetles). Did you notice that house fly is two words, whereas firefly is one word? In most cases, you can identify the impostor because its name is one word. The exercises in Meeting 7 help members to learn these differences and give them practice using a collecting guide. The exercises will help them if they choose to put the scientific name on the label card.

Constructing a collection box will give the members a place to display their insects. You should stress to the members that they should take pride in their work because it represents them when they display their insects.

Purpose and objectives

Members should:

- explain how to develop a scientific name
- learn how to distinguish the adult stage of a true fly or bug from one that is not
- construct a collection box

Materials needed for this meeting

You will need:

- collection box materials (See Member's Guide.)
- moth balls

Procedures

1. Discuss members' concerns as they prepare their collections.
2. Go over the exercises "The Name Game" and "Find the Impostors."

The Name Game

Example. musca domestica (house fly)

Musca domestica

1. Danaus plexippus (monarch butterfly)

Danus plexippus

2. Periplaneta Americana (American cockroach)

Periplantera americana

3. Schistocerca americana (American grasshopper)

(correct as is)

4. drosophila Melanogaster (fruit fly)

Drosophila melanogaster

5. Solenopsis Geminata (fire ant)

Solenopsis geminata

Here is another exercise for you to practice. See if you know which insects are real and which are impostors. You may have to look up these insects in a guide to help you find the correct answers. What you want to do is find the insect listed in the exercise. (Try using the index in the back of your guide or look up the insect in your Member's Guide.) Write down the insect order. You will then know which insect is a true fly (Diptera) or a true bug (Hemiptera) order and therefore know the impostor.

Example: housefly

Diptera

butterfly

Lepidoptera

Circle the one that is a true fly. How should the name be spelled?

house fly

1. bottlefly

Diptera

dobsonfly

Neuroptera

Circle the one that is a true fly. How should the name be spelled?

bottle fly

2. giant waterbug

Hemiptera

spittlebug

Homoptera

Circle the one is a true bug. How should the name be spelled?

giant water bug

3. cranefly

Diptera

caddisfly

Trichoptera

Circle the one that is a true fly. How should the name be spelled?

crane fly

4. lightningbug

Coleoptera

bedbug

Hemiptera

Circle the one is a true bug. How should the name be spelled?

bed bug

5. mayfly

Ephemeroptera

horsefly

Diptera

Circle the one that is a true fly. How should the name be spelled?

horse fly

6. dragonfly

Odonata

fruitfly

Diptera

Circle the one that is a true fly. How should the name be spelled?

fruit fly

3. Construct a collection box. See instructions in the Member's Guide.
4. Remind members that presentations and collections are due next time.

Looking ahead

Set up the room ahead of time so that the insect collections can be viewed and displayed in a circular arrangement. This arrangement will also be appropriate for the presentations.

Topic introduction

This is the final meeting of your entomology group. Everyone should be relaxed. Before giving their presentations, members should display their collections and look at each collection for the first half hour. This will get members interested. Then have members make their presentations. Following the presentations, go around to each collection and have members say good things about it. Plan to enter the collections in a 4-H Roundup or county fair. Contact the local cooperative extension office for more details.

Purpose and objectives

Members should:

- prepare their collections for presentation
- use visual aids in making presentations
- present and practice speaking to a group of members

No materials needed for this meeting.

Procedures

1. Have the members display their insect collections.
2. Have them make their presentations.
3. Construct a collection box. See instructions in the Member's Guide.
4. Remind members that presentations and collections are due next time.

Collection Activities

ACTIVITY 1.

What differences did you observe between insects found in a flower garden and those in a hayfield (clover or alfalfa)?

Collect insects in a hayfield and a flower garden on four different dates, during May, June, July, and August. Select 10 different insects collected from each location. Record the time you collected them, and mount them on insect pins. Keep them in your insect collecting box. Identify them according to insect order and label them correctly.

Where did you find the most species of insects? Where did you find the most colorful insects? Did you find the same kinds of insects on the different dates? What month did you find the most insects in the hayfields? What month did you find the most insects in the flower garden? Which insects were harmful? Which were beneficial?

ACTIVITY 2.

What differences are there among insects in a field compared to those near lakes, rivers, or ponds?

On four different dates, during May, June, July, and August, collect as many insects as you can in and around lakes, rivers, or ponds. Compare these insects with those you can collect in a clover or an alfalfa field. Mount at least 10 different kinds of insects from each area. Keep them in your insect collection box. Identify them according to insect order and label correctly.

Where did you find the most species of insects? Where did you find the most colorful insects? Did you find the same kinds of insects on the different dates? During what month did you find most of the insects in the rivers, lakes, or streams; in the hayfield?

ACTIVITY 3.

Can insects be attracted with baits?

Obtain three quart jars. Lay them on their side in a place where direct sunlight will not reach them and small animals or dogs cannot disturb them. In one jar, place a small amount of raw hamburger. In another, place some ripe fruit, such as cantaloupe or watermelon rinds, apples, or peaches. In the third jar place one or two slices of bread. Moisten each jar with a little water. (See Meeting 8 in the Member's Guide.) Collect as many different kinds of insects as you can from each of these jars after one day, three days, and one week. How many insects did you attract? Make a list of the insects you can name. How many different species were you unable to name?

Often in bait traps, large numbers of one species of insect will be collected. It will not be necessary to collect more than one or two specimens of each type. Identify the specimens according to the insect order and label them correctly.

What bottle and bait attracted the most insects? Are all of the insects in each bottle the same? Did you find the same kinds of insects in each bottle one day after you placed the bait as compared to a week later?

ACTIVITY 4 .

Do female moths attract male moths?

In the evening, place a freshly collected, live female moth in a cage. Observe the area around the cage at hourly intervals to see if males are attracted. Sex can be determined by the shape of the antennae. Females have thread-like antennae, while males have "bushy" antennae. Repeat this activity with other species of moths. Can this information be useful for insect pest management?

ACTIVITY 5.

Are insects attracted to light?

During the warmer months, place a light bulb on an extension cord about 10 feet from a building. After dark, turn the light on and leave it on for about an hour. Collect and mount 10 different insects you find around the light at night. Compare them with the insects you collect during the daytime. Do this on four different dates, during May, June, July, and August. Identify these insects according to insect order and label them correctly.

Did you find the same kinds of insects in the daytime as you did at night? When did you collect the most colorful insects, in the daytime or at night? Did you find different kinds of insects during the different months?

ACTIVITY 6.

Are insects attracted to different colored light bulbs?

Place red, blue, yellow, and white light bulbs on extension cords about 10 feet from a building. Each bulb should be about 50 feet from another bulb. After dark, turn the lights on for about an hour. Collect and mount the different insects you find around each light bulb. Be sure to keep a record of what insects you found around each colored light bulb. Do this on four different dates, during May, June, July, and August.

What color was most attractive to insects at night? What color was least attractive? Were any of the insects more colorful than others? Did you find the same kinds of insects around each of the different colored light bulbs? Did you find the same kinds of insects around these different colored light bulbs during the different months?

Mount at least 10 insects from each group. These may be used for display purposes. Identify them according to insect order and label them.

ACTIVITY 7.

Make a collection of cocoons or chrysalises (four or more). How many different kinds can you find? Place each one in a separate

container with a cover. Place a twig or branch in the container for the adult to rest on. After the moths or butterflies emerge, mount both the adult and the cocoon for display purposes. Make a display of four or more cocoons or chrysalises with the adults.

ACTIVITY 8.

Collect 10 or more colorful insects. How many different colors and shades can you find? These can be mounted in a display case.

ACTIVITY 9.

Make a display of insect parts. Collect 25 large insects and remove the wings with scissors or tweezers, being careful not to break the insect wing. Using fast-drying glue, mount insect wings on a white piece of cardboard. An attractive and colorful display can be made that illustrates the great variation in insect wings.

ACTIVITY 10.

Show the life cycle of an insect by finding eggs, larvae, pupae or nymphs, and adults.

Mount the eggs on cardboard using fast-drying glue, or preserve them in a small bottle of 70 percent ethyl alcohol. Preserve the larvae in small bottles of 70 percent ethyl alcohol. The pupae or nymphs and adults can be mounted on insect pins or glued directly on hard cardboard. In a library, find more information about the life cycle of the insects you have mounted.

How long does it take for the eggs to hatch? How many eggs does this insect lay? What do the larvae feed on? How long does it take the larvae to pupate? How long does it take the pupa to emerge as an adult?

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abdomen (ab´ doe min): the part of an insect's body behind the thorax that contains the organs of digestion and reproduction.

antennae (an ten´ ay): the rod or feather-shaped projections on the front of the head that serve as organs of touch and sometimes taste, smell, and hearing. They are often called "feelers."

Arachnid (A rack´ nid): spiders and their relatives.

Arthropods (Arth´ ro pods): the phyla that insects are in, meaning "jointed legs."

Chilopoda (Chill a pode´ a): centipedes.

chitin (kite´ in): the material is found in the exoskeleton of insects.

complete metamorphosis (met a more´ foe sis): four different stages of growth, including egg, larva, pupa, and adult, as found in butterflies, moths, flies, bees, wasps, and beetles.

exoskeleton (x o skell´ it tin): a skeleton (hard covering) on the outside of the body which gives an insect protection.

Diplopoda (Dip low pode´ uh): millipedes.

Hexapoda (Hex a pode´ a): insects.

incomplete metamorphosis (met a more´ foe sis): a process of change in which insects such as grasshoppers, termites, true bugs, aphids, leafhoppers, and earwigs hatch from an egg, become a nymph, molt, and develop a full set of wings, thereby becoming an adult.

invertebrates (in vert´ i brates): animals without a backbone.

key: a set of characteristics organized in branches to help the user narrow down choices and identify a particular insect.

larva (lar´ vuh): the immature stage that occurs after insects that undergo complete metamorphosis hatch from the egg; larvae sometimes resemble caterpillars or worms.

membranous wings (mem bran´ us): clear wings with veins showing through, as on a dragonfly.

metamorphosis (met a more´ foe sis): a process in which insects grow up and change their form.

molting (molt´ ting): the process by which an insect sheds its skin to grow larger until it is the full size of the adult.

nymph (nimff): the immature stage of an insect that does not have wings.

proboscis (pro bos´ sis): a siphoning mouthpart in butterflies and moths that is like a straw to help suck up nectar.

prothorax (pro thor´ axe): part of the neck area that is used for pinning some insects.

pupa (pew´ puh): the stage of complete metamorphosis between the larva and the adult.

scales: tiny, shingle-like parts of butterfly and moth wings that rub off like powder.

scientific name: a Latin name for insects that is made up of the genus and species.

scutellum (skew tell´ um): the triangular area between the bases of the wings on some insects

simple metamorphosis (met a more´ foe sis): the process of metamorphosis in which insects such as silverfish, springtails, and lice hatch from an egg and look exactly like a small form of the adult insect

siphon (si´ fun): tube-like mouthpart that takes up food.

thorax (thor´ axe): the middle part of an insect where the legs and wings are attached.