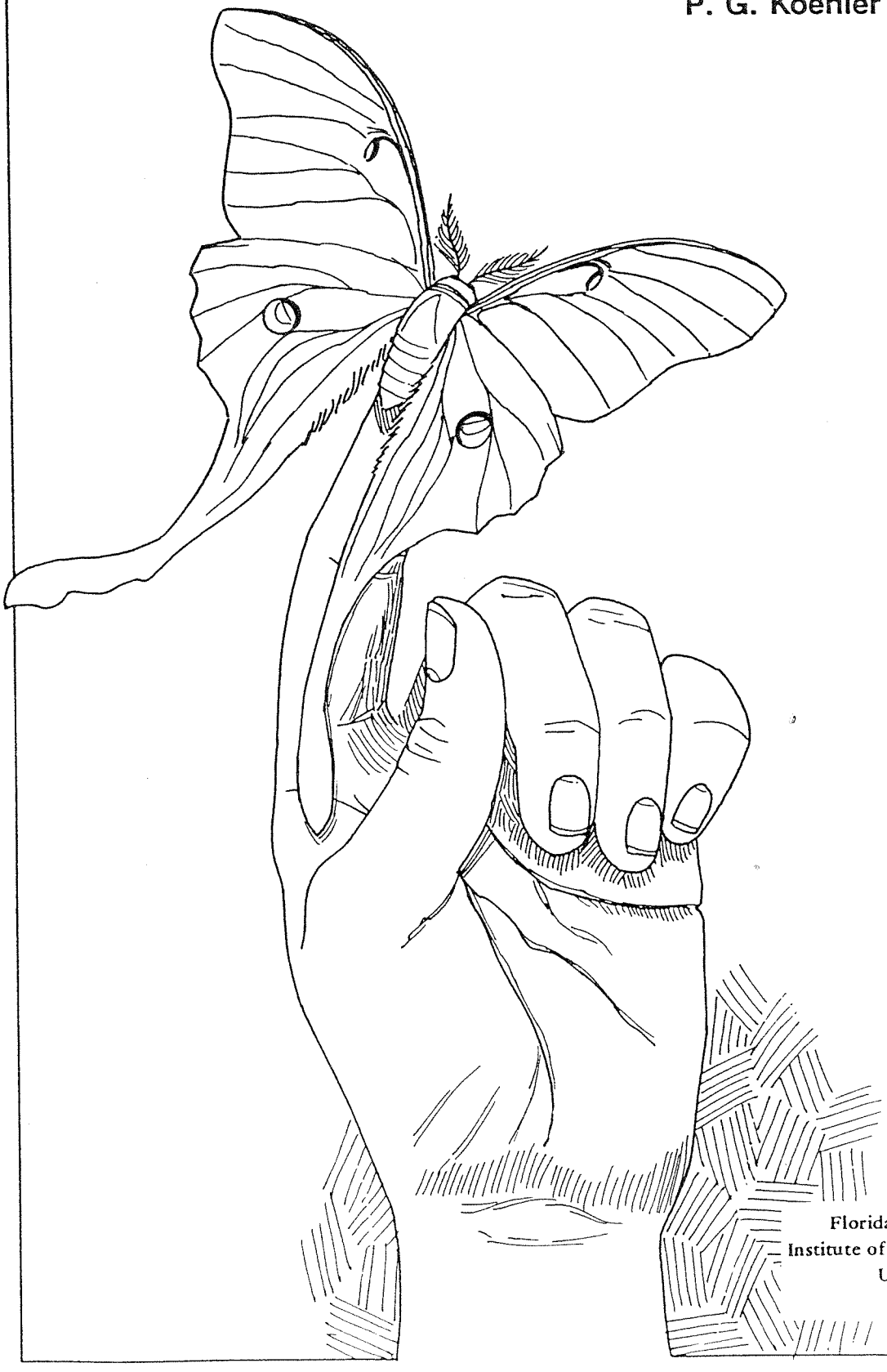
4-H ENTOMOLOGY PROJECT
ADVANCED LEVEL

P. G. Koehler and J. C. Northrop



Florida Cooperative Extension Service
Institute of Food and Agricultural Sciences
University of Florida, Gainesville

*P.G. Koehler is a professor and extension entomologist, Entomology and Nematology Department; J.C. Northrop is an associate professor and extension 4-H youth specialist; IFAS, University of Florida, Gainesville 32611.

4-H ENTOMOLOGY PROJECT ADVANCED LEVEL

Working with Insects

NAME _____ DATE _____

ADDRESS _____

AGE _____ THIS IS MY _____ YEAR IN 4-H CLUB WORK

YEAR IN 4-H ENTOMOLOGY PROJECT _____ LEADER _____

NAME OF CLUB _____ COUNTY _____

COUNTY EXTENSION AGENT _____

WELCOME

Your enrollment in the Advanced Entomology Project indicates an interest in insects and a desire to learn more about these fascinating members of the animal kingdom.

By completing the Intermediate Level Project, you have learned a great deal about insects in general. In this project, you will learn many interesting facts about individual insects, such as how and where they live, what they eat, their stages of development, and most important, their relationship to man and his economy.

What you learn from this project will help in many other 4-H projects. You will better understand insect problems throughout your lifetime. Keep your Intermediate Project Book as a reference. It will help in completing the Advanced Project.

In continuing your advanced work in the 4-H Entomology Project, you may also become interested in 4-H Integrated Pest Management. An entire set of 4-H materials is available in pest management which may be a valuable reference in your entomology project. The activities accomplished in 4-H Integrated Pest Management can be reported in the Advanced Entomology Record at the back of this booklet.

ACKNOWLEDGEMENTS

This educational material has been adapted from publications developed by Entomology Program Development Committee, composed of representatives of the State and Federal Extension Services, the National 4-H Service Committee, and Hercules Inc., National Donor. Special acknowledgement is given to cooperators in the State Cooperative Extension Services who have supplied material included in this publication, especially Dr. John Strayer, Professor of Entomology, University of Florida.

LET'S STUDY INSECTS FURTHER

You can study insects in several ways. You can read books about them in your school or county library, observe actions of living insects in their natural surroundings, rear insects in easily constructed cages, or study insect collections in museums, schools, or private collections. Keep accurate records of your entomology work which you can use further for reference material.

Many people collect and identify insects for a hobby; others make the study of insects their life's work. As you continue in 4-H Entomology, you will have opportunities to use your talents. The more you study insects, the more answers you will have to the question, "Why study insects?"

Suggested Learning Experience

As a 4-H member, you may continue work in the Advanced Level for several years. Your accomplishments should be more in-depth with each succeeding activity. Information on each activity should be recorded in your Project Record at the back of this book.

PROJECT GOALS

a. Give a talk to a group about insects.
b. Continue to expand your insect collection. Collect, mount, and label properly a total of 50 Florida insects representing 8 Orders.
c. Collect and preserve immature forms of ten insects representing five or more Orders, such as grubs, caterpillars, and maggots.
d. Rear one beneficial insect through its life cycle and preserve all stages of development.
e. Rear at least one pest insect from egg to adult. Record information concerning days in each stage of development. Mount or place each immature stage in alcohol and add to your collection.
f. Make a glass-top display case and a relaxing jar.

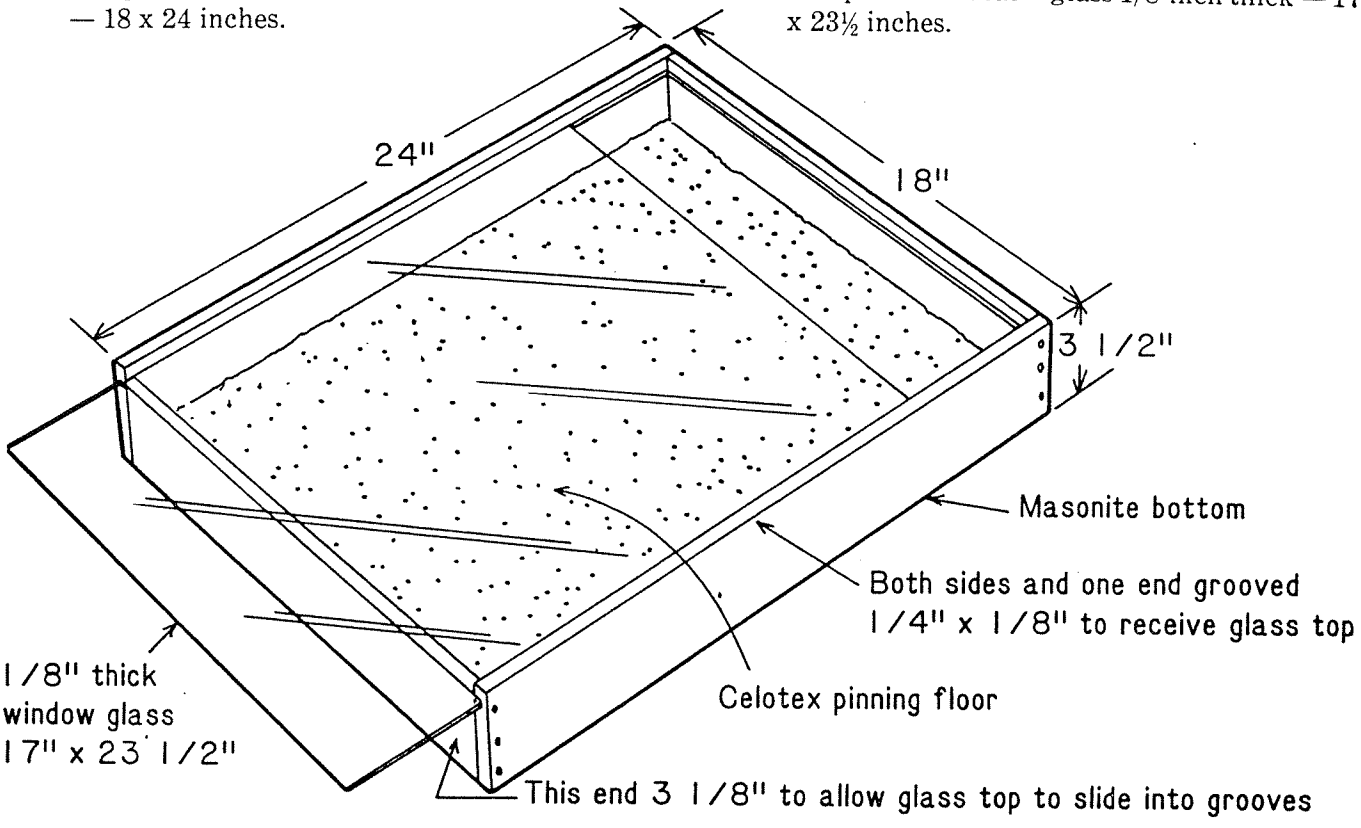
EXPANDED PROJECT GOALS

a. Collect, mount, and properly label a total of 75 Florida insects representing 12 Orders. Add these to your insect collection.
b. Rear at least five insects from egg to adult. Record information concerning days in each stage of development. Mount or place each immature stage in alcohol and add to your collection.
c. Conduct an insect management program on the garden, crops, livestock, pets, or in the home.
d. Make a collection of as many different insect homes as you can find in your community.
e. Make a collection of: Arthropods other than insects (such as centipedes, millipedes, spiders, mites, and ticks), insects of medical importance, insects of veterinary importance, insects which attack vegetables, or insects which attack ornamentals.
f. Make a collection of plant or animal material showing insect feeding signs and identify the insect responsible.
g. Make an educational display of an insect or group of insects important to the general welfare of your community — use posters, pictures or drawings. Display your exhibit at an appropriate function in your county or state.
h. Visit with and observe the operations of a pest control operator, insecticide dealer, beekeeper, aerial applicator, regulatory or public health official and write a report on your observations.
i. Apply an insecticide to control an insect infestation. Report to your club safety precautions used in mixing and applying the insecticide, and results obtained.
j. Give a talk or demonstration to your club, school or community group on the importance of a good insect management program.
k. Give a talk to a community group on a national, state, or local insect quarantine program, such as imported fire ants, citrus blackfly, or mediterranean fruitfly.
l. Survey for and report to your County Extension Agent on the prevalence and distribution of an insect species in your area.
m. Make an observation study and report insect activity related to a host, time of day or night, or weather and temperature conditions.
n. Prepare a report on one or more insects found, how they live and multiply, and the damage they cause to one or more of the following: field crop; animal or man; household; vegetable or flower garden; pasture or lawn.

Making A Glass Top Display Case

Materials needed for a glass-top display case, 18 x 24 inches:

1. One piece of masonite or hardboard for bottom — 18 x 24 inches.
2. Two side pieces of pine — 3/4 x 3½ x 24 inches.
3. One end piece of pine — 3/4 x 3½ x 16½ inches.
4. One end piece of pine — 3/4 x 3⅛ x 16½ inches.
5. One piece of Celotex or similar soft fiberboard for pinning floor — 16½ x 22½ inches.
6. One piece of window glass 1/8-inch thick — 17 x 23½ inches.



Making a Relaxing Jar

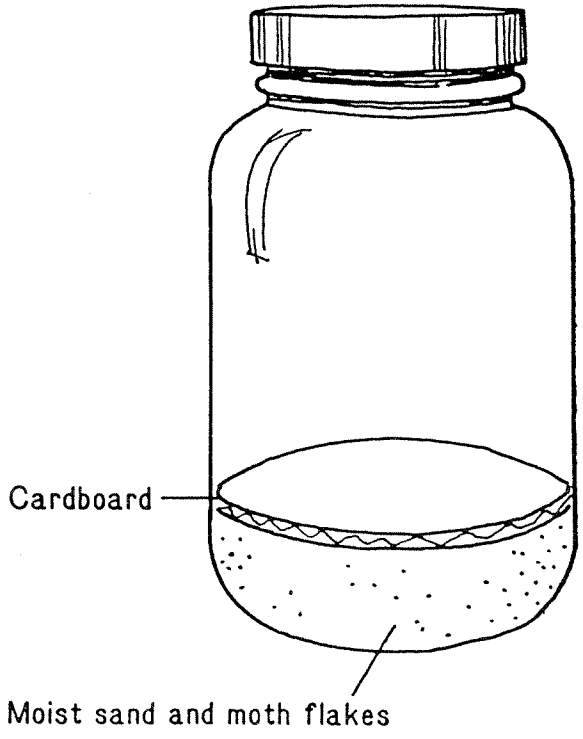
Sometimes insects such as butterflies and moths get too dry and become too hard and brittle for mounting. Body parts are easily broken when trying to pin for mounting. They should first be placed on a piece of cardboard in a moist wide-mouthed jar or can with a tight lid. It usually takes several hours (12 to 24) for most insects to relax. Check the specimens occasionally to keep the insect from becoming too wet or too soft.

Materials needed:

1. Wide-mouth jar or can (gallon pickle jar)
2. Sand
3. Naphthalene flakes (moth flakes)
4. Cardboard

How to make:

1. Pour one inch of sand in the bottom of the jar or can and moisten with water.
2. Add a few pinches of naphthalene flakes to prevent mold.
3. Cut a piece of cardboard and fit tightly over sand.

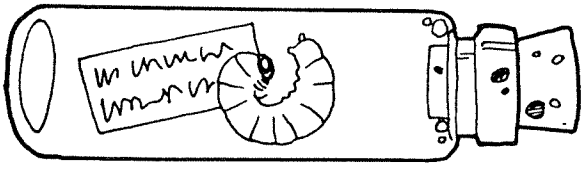


Preserving Immature Insects and Other Arthropods

Small vials or bottles and 70% alcohol can usually be obtained at your local drugstore. Vials or bottles (about 1/2 x 2½ inches) with cork or screw cap may be used.

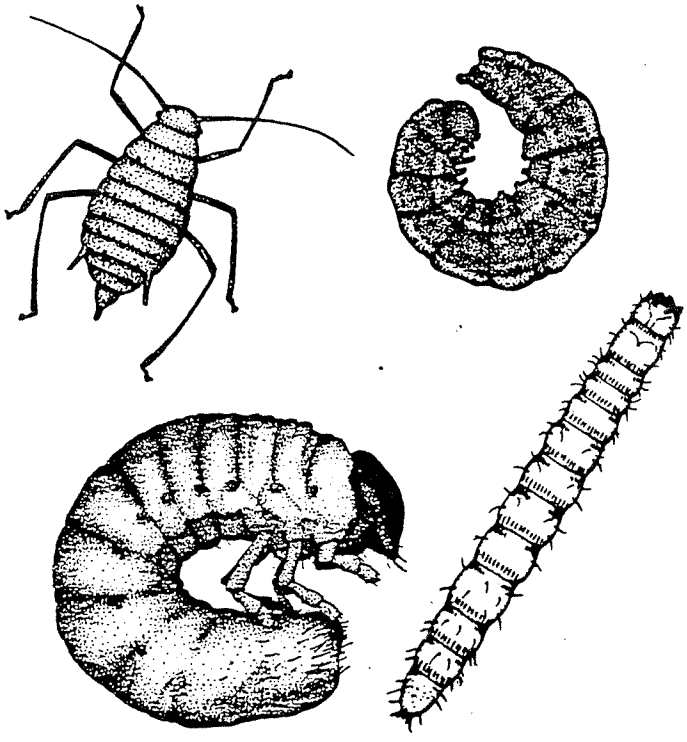
How to use:

1. Kill the specimen in hot water (180°F). It may take several minutes.
2. Fill the vial with 70% alcohol and drop the specimen in the vial.
3. With a soft lead pencil, write where collected, date, host, name of insect, and your name on a piece of index card that will fit inside the vial.
4. Place the label in the vial and cork or cap tightly.



Note: A mixture of one part ethyl acetate (acetic ether) and eight parts of 70% alcohol retains color in insects better than 70% alcohol used alone. Labels made with ink instead of lead pencil will fade and become hard to read through the vial. Labels placed on the outside of the vials may be lost, soiled, or faded.

Some members may wish to use vials and alcohol to preserve other than immature insects that cannot be mounted on points. Such insects as aphids, thrips, lice, book lice, termites, and snowfleas can be preserved in this manner. Other Arthropods such as centipedes, millipedes, spiders, mites and ticks can be preserved in this manner.



Rearing Insects

An easy way to learn about insects is to study their life cycle by rearing insects in captivity and making daily observations. Rearing cages made of screen wire, or large glass jars with cheese cloth or screen wire tops can be used.

Most butterflies or moths can be reared by collecting eggs or young caterpillars and providing fresh food from the plants where they were found. Place them in large pickle jars or cages made of screen wire rolled into a cylinder. Close the ends with wooden disks or cardboard. Place an inch or two of soil in the bottom of the cage (many caterpillars pupate in soil). Place a branch in the jar for the adult to climb on when it emerges.

Plant-feeding beetles can be reared on a potted plant in a screen cage placed over the plant, or in a cage placed over the plant in the garden. The larvae pupate in the soil.

Houseflies can be reared in glass jars with a small dish or jar cap filled with damp bran cereal and a little sugar in the bottom of the jar. Keep the bran cereal moist but not soaking wet. Manure is also an excellent rearing medium.

Cockroaches can be reared in fruit jars in which bran, dog food or other food products have been placed. Observe the egg capsules (generally found on the abdomens of adult roaches) until they are almost ready to hatch. Rearing roaches will require several weeks.

Plant lice (aphids) are easy to rear on a host plant which has been potted and covered with a glass jar or placed in a glass jar. Young aphids are generally born alive.

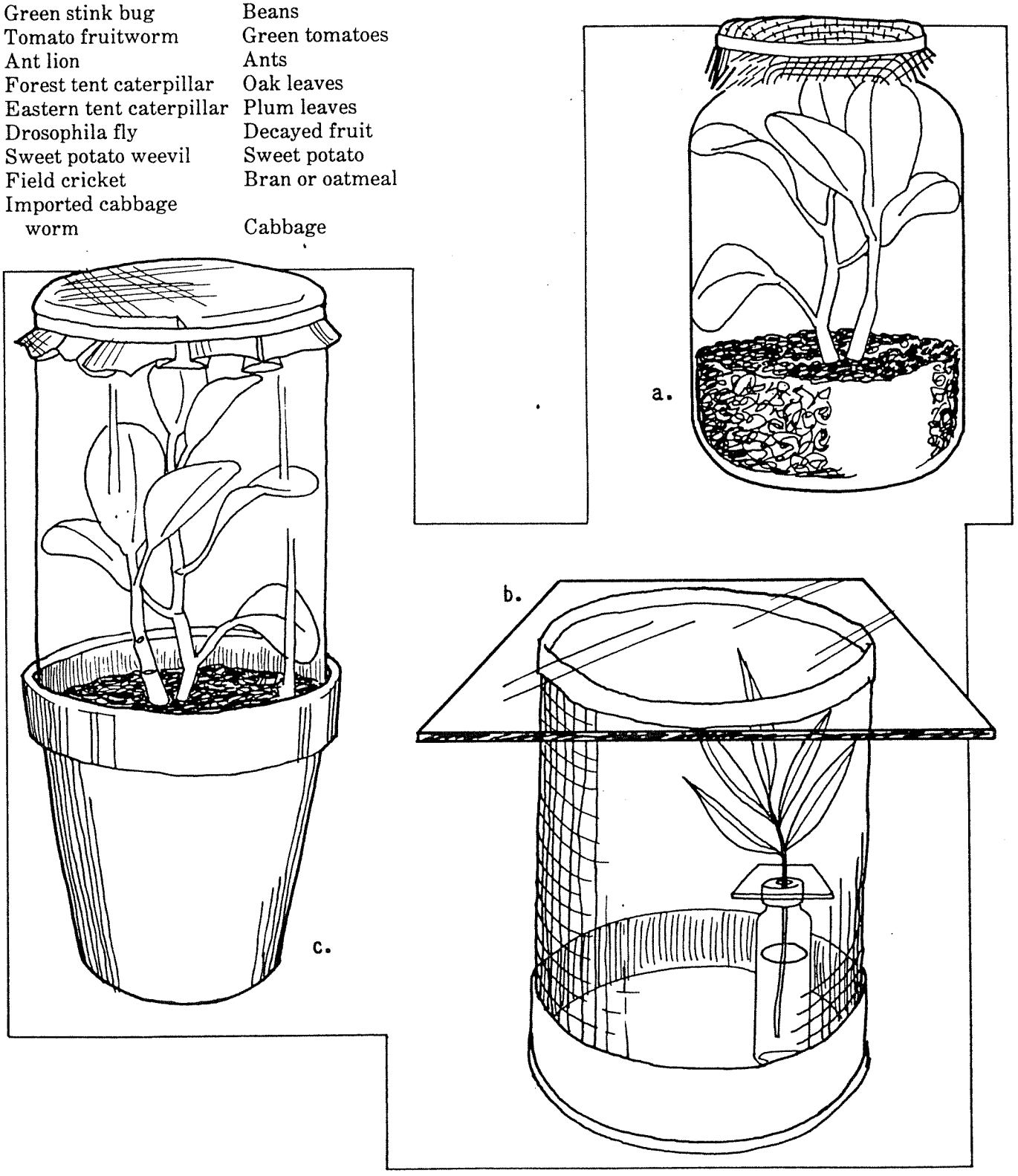
Rear lady beetles from eggs or small larvae caged with a colony of aphids on a host plant. Lady beetles consume large numbers of aphids, so be sure the food supply is plentiful.

Many other kinds of insects can be reared in simple cages. Use your imagination. Some examples of insects, suitable for rearing, together with their food or host plants are:

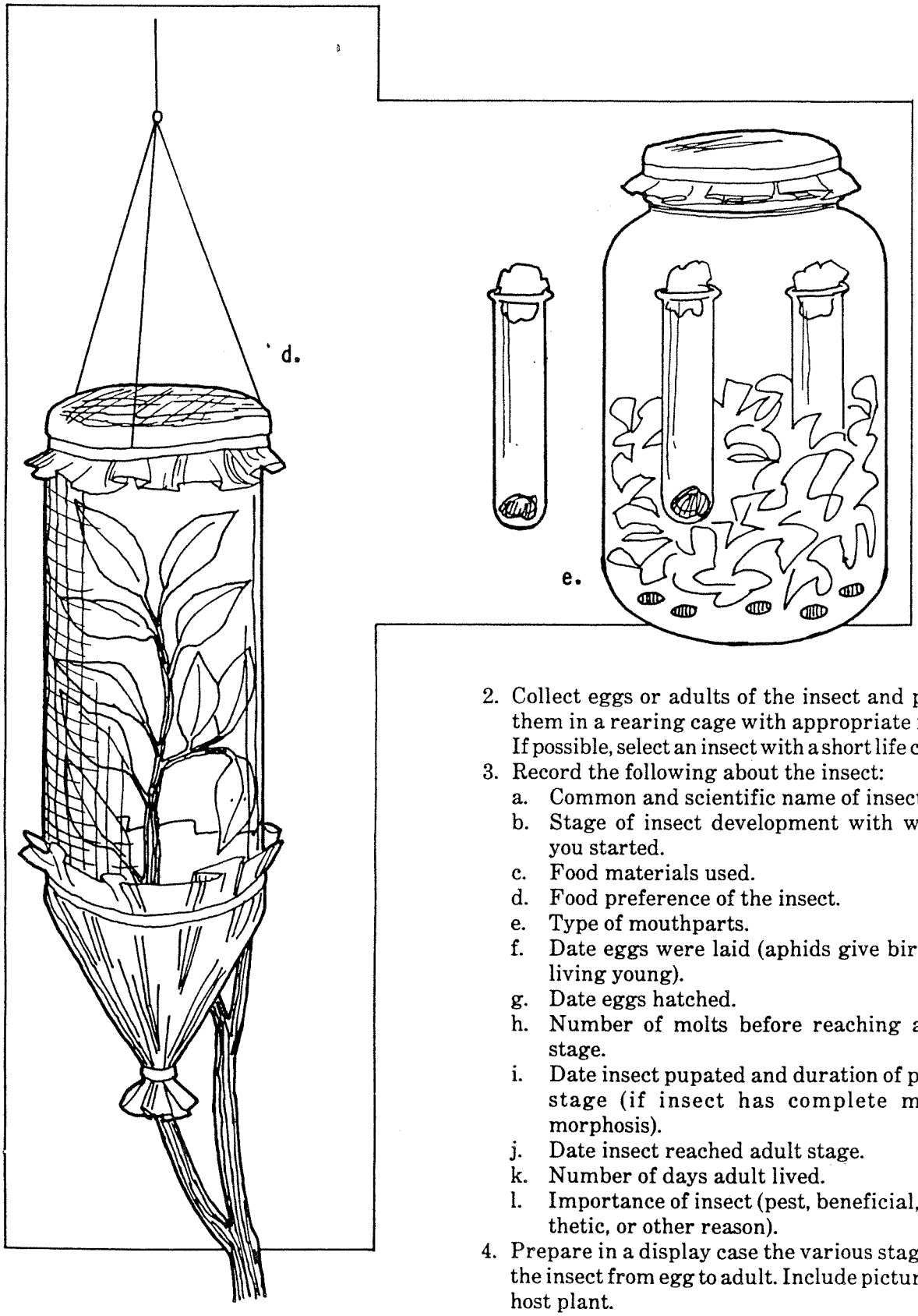
Insect	Food or Host Plant
Blow fly	Meat
Earwig	Live flies, termites or bran
Leaf-footed bug	Tomato fruit
Green stink bug	Beans
Tomato fruitworm	Green tomatoes
Ant lion	Ants
Forest tent caterpillar	Oak leaves
Eastern tent caterpillar	Plum leaves
Drosophila fly	Decayed fruit
Sweet potato weevil	Sweet potato
Field cricket	Bran or oatmeal
Imported cabbage worm	Cabbage

Procedures:

1. Select a rearing cage appropriate for the insect. Types of cages include:
   a. The simplest type cage — food and/or water may be placed in the bottom of a jar.
   b. A more permanent-type cage made of wire, screen, and tin.
   c. A "flowerpot" cage.



d. A plastic or wire screen cage for rearing insects in the field.
e. A cage for rearing blowflies.



2. Collect eggs or adults of the insect and place them in a rearing cage with appropriate food. If possible, select an insect with a short life cycle.
3. Record the following about the insect:
   a. Common and scientific name of insect.
   b. Stage of insect development with which you started.
   c. Food materials used.
   d. Food preference of the insect.
   e. Type of mouthparts.
   f. Date eggs were laid (aphids give birth to living young).
   g. Date eggs hatched.
   h. Number of molts before reaching adult stage.
   i. Date insect pupated and duration of pupal stage (if insect has complete metamorphosis).
   j. Date insect reached adult stage.
   k. Number of days adult lived.
   l. Importance of insect (pest, beneficial, aesthetic, or other reason).
4. Prepare in a display case the various stages of the insect from egg to adult. Include pictures of host plant.

Collecting Insect-Damaged Plants

Plants injured by insects can be collected, pressed and preserved for future reference and study. Properly prepared and dried specimens will last for many years, if cared for correctly.

Making a Plant Press

The plant press is a simple device consisting of two sheets of hard board or masonite, 14 x 18 inches. Newspaper and corrugated cardboard are used as driers between the hard board covers of the plant press. These driers take up moisture from the plant. It is necessary to make the plant press before collecting is done. This activity is good for fall and winter.

Collecting Plants

Plants that are protected by law should not be collected. Be sure permission is obtained from the landowner if collecting is done on property other than your own. Equipment for collecting plants includes:

a. Plastic bag in which to put the plants,
b. Scissors or knife for cutting specimen,
c. Pencil and paper for taking notes.

Always try to collect mature plants that illustrate which type of damage you wish to show. Place the specimen in a plastic bag to prevent drying. Record on a sheet of paper the name of the plant, where it was obtained, the township or nearest town, the county, state, and the date.

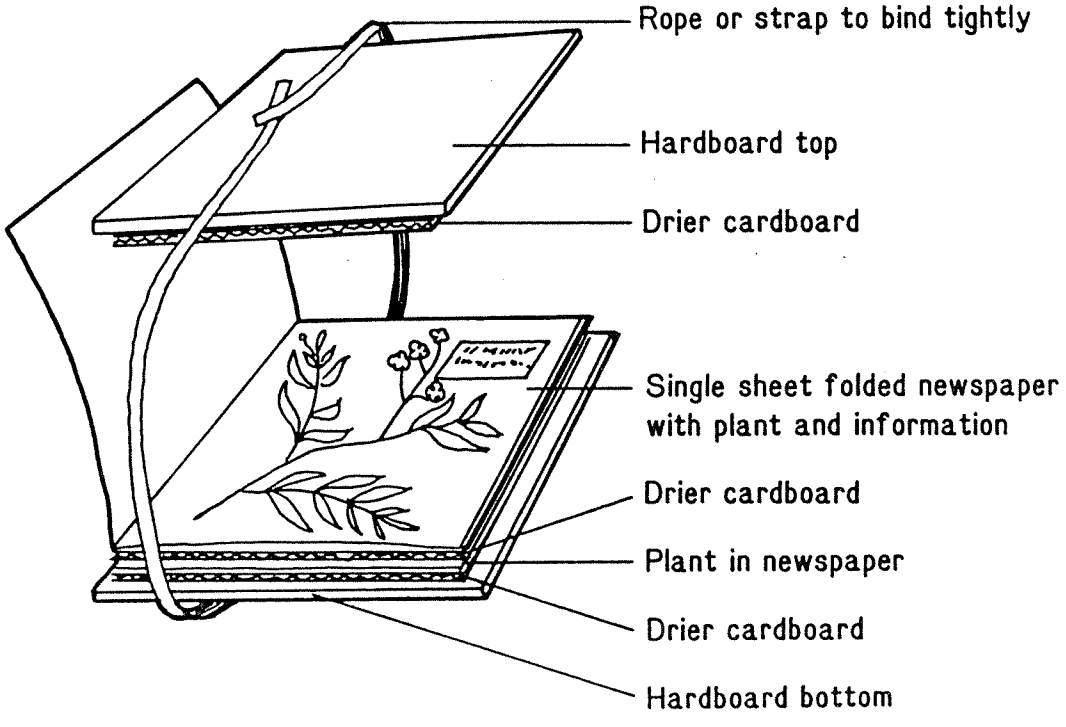
Note the kinds of insects seen on the plant and those that have injured it. Additional information on where the plant was growing (woods, marsh, or roadside, etc.) is also interesting. Record whether the site was sunny or shady; whether the soil was sandy, loamy, or clay; if the plant is colored or in blossom, and the color of the blossom (as plants dry, the color usually disappears). Keep this information with the specimen.

Pressing Plants

As soon as you return from a field trip, put the plants in the plant press:

a. Place one piece of hard board on a table.
b. On top of it, place a corrugated cardboard drier.
c. Take a single sheet of newspaper and fold it in half so it just fits the drier.
d. The paper should be unfolded and the plant placed between layers. Arrange the plant so that blossom, stem and leaves are in the position desired when the plant is dry.
e. Place plant notes in the press with the plant.
f. Fold the newspaper over the specimen and place another drier on top of the newspaper.
g. Follow with another plant and another drier. The process is repeated until all plants are in the press.
h. The hard board cover is put on the top drier and the press is either tied or strapped tightly, or weighted, so there is pressure on the specimens.

After 24 hours, the plant press can be opened. Each specimen should be examined and the leaves

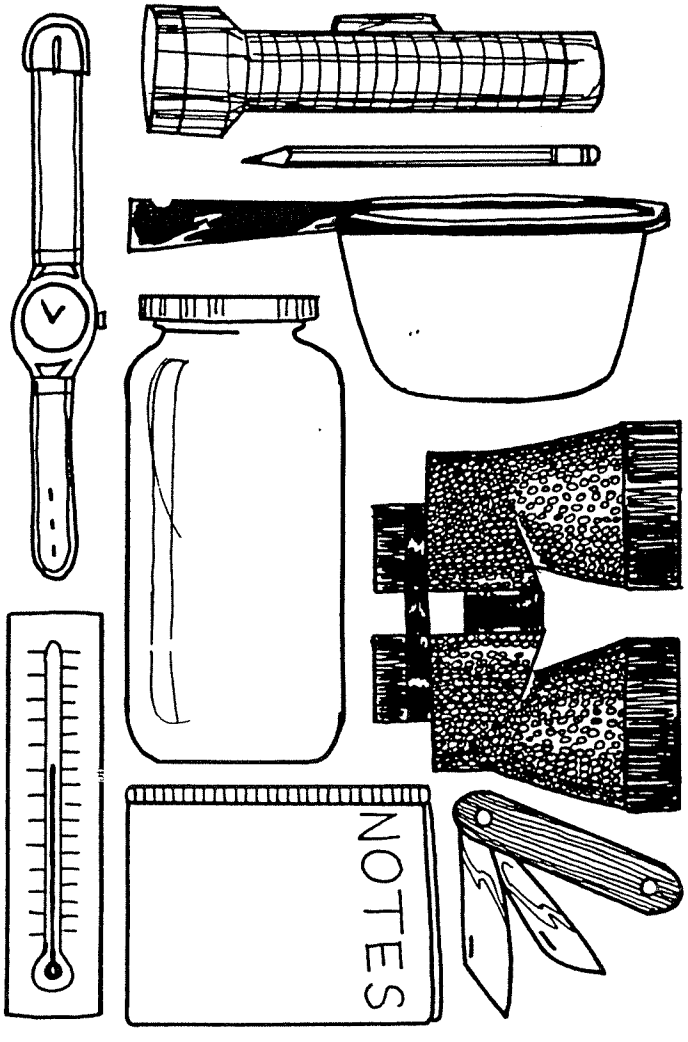


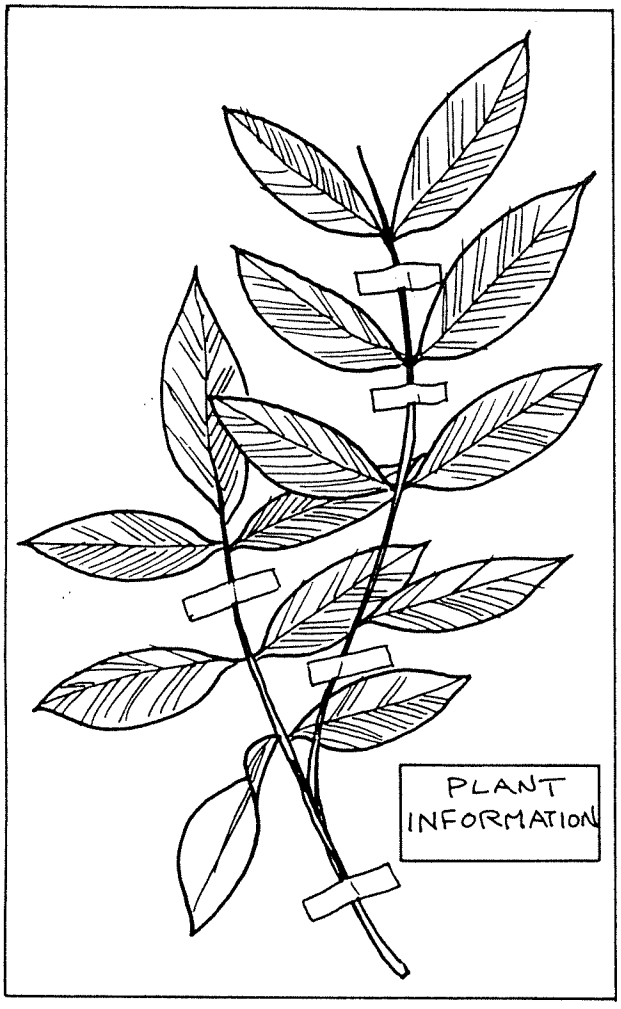
rearranged to properly illustrate what you would like to show. At least one of the leaves should be turned so the bottom side is visible. If the stem crosses over the leaves, the leaves should be arranged so they are beneath the stem. The damp driers are laid aside to dry and new, crisp, fresh driers inserted in their place.

This process should be repeated daily until the plants are perfectly dry. You can tell when a specimen plant is dry by holding it to your cheek. If it feels cool, it is probably still moist. The plants should be kept in their original folded newspaper throughout the drying process.

Mounting Plants

When the plants are dry, they can be mounted on stiff paper. Plants can be fastened by applying glue to the undersurface of the plant and applying pressure until the glue has set. If you use tape, be sure it is the kind you moisten and stick. Tape on which glue remains permanently sticky is apt to leak, thus spoiling your collection. Plants should be labeled with the name and other information you obtained when you collected the specimen.





Other Suggested Activities

Record all information on any activity you have completed and write a report of work for your record book.

Observation Activities

Observing insect life in action is a fascinating activity. Write in a notebook interesting or unusual events you see while watching insects. Watch insects at a pond or field, ants' nest, flower garden, forest or other area of interest. Observation can be done in the morning, noon, evening or night for a period of one to three or more hours. Explain the relationship of the insects to plants, animals, birds, fish or man. Suggested materials to take along are a notebook, pencil, field glasses or binoculars, glass bottle or jar, watch, flashlight or other light, thermometer, pan and pocket knife.

1. Do most fish relish insects as a major source of food?

Collect a handful of large insects, such as grasshoppers, crickets, moths or flies. Toss them in a stream or lake containing trout, bass or pan fish. What happened to these insects? Were there any insects that the fish refused to eat?

2. Prove that fish use insects as food.

Open the stomach of ten fish such as trout, bass or pan fish. Empty the contents from the stomach into a pan of water (a white pan or plate works best). Can you identify any insects or insect parts from the contents found inside the stomach? Estimate the approximate percentage of material found in the stomach that consisted of insects or insect parts for each species of fish.

3. To what extent are birds dependent on insects for feeding their young?

Find nests of two different types of birds, such as bluebirds, wrens, mockingbirds and grackles when the young are about half grown. Observe the parents feeding these young for one-half hour on three separate days. Be careful not to disturb the nest or birds. Use binoculars if available and remain hidden from the birds. What kind of food did the parents feed their young for each species of bird?

4. Are flying insects caught by certain kinds of birds while in flight?

During a summer evening (twilight), watch birds in flight for half an hour, such as swallows, night hawks, and fly catchers. Do they fly in a straight line or do they seem to go after certain things in the air? Why do you think they fly in such a manner? Do you ever see these birds eat seeds, plants or worms in a garden? Why not?

5. What is the food of spiders? Are they selective in what they eat?

Capture a spider and place it in a glass bottle with a screen cover or a cover with a number of small holes. Do not place it in direct sunlight, as the heat will kill the spider.

Catch a live fly, being sure not to crush or kill it. Place it inside the jar with the spider. What happened to the fly? Are spiders beneficial? Catch an insect such as a cricket or ground beetle and place it inside the jar with the spider. What happened?

6. Do certain insects eat other insects? Can lady beetles be used to control aphids?

Locate a plant containing a large number of aphids or plant lice. Do you notice other types of insects or insect larvae feeding on these plant lice? Watch one specific insect feeding on these plant lice. How many does it eat in 15 minutes? Will this specific insect feed on other insects such as moths, crickets, or flies? Place several lady beetles on a plant with aphids. After two days, observe if aphids are disappearing.

7. Observe dragonflies or damselflies. What is the food of a dragonfly or damselfly?

Do they fly in a straight line from place to place or do they dart around? Why do you think they dart around as they do?

8. What traits do insects have that walk on the surface of the water?

Locate a pond of water preferably in a wooded area. Do you see any insects that can swim or walk on the top of the water? Capture an insect from a nearby plant and drop it into the water. Can it move over the water as rapidly and easily as those you found normally living on the water?

9. Find cases of interesting adaptations in insects, like mimicry or protective resemblance.

Do three of the five. Find one insect or insect larva that:

a. Looks like a twig. (What happens when larva is disturbed? left alone?)
b. Looks like bark of a tree.
c. Is green like leaves of plants.
d. Has spots that look like eyes of larger animals.
e. Is the color of the flower you found it on.

10. Do communal insects each have special jobs?

Observe insects that work together, such as bees, ants and termites. Do they fight among themselves for feed or space? Do they all do the same thing or have the same job? Drop an ant from another colony into the group. Is it accepted? Drop some other insects into the group. What happens? Try particles of food and observe results.

Experimental Activities

1. Are spilled insecticides harmful to life in water?

Find some mosquito larvae (wigglers). Place equal numbers of them in three separate jars of river or pond water. About ten in each jar is sufficient. Place a small minnow in the first jar. In the second jar, place about two drops of an insecticide you might have in your house and leave the third one uncovered. After two days, describe what happened in each jar. Place two drops of an insecticide in the jar containing the fish. Describe what happened. Why is this information important?

2. Does water temperature affect the time needed for mosquito emergence?

Locate a pond or pool of water that contains a large number of mosquito larvae. With a dipper or cup, capture 25 live larvae and place them in a pan of water. Fill the rest of the pan to a depth of one or two inches with water from the same pond or pool. Place a tight-fitting screen over the pan and place it in a cool area, such as a basement or shaded corner of a garage. In another pan of water, place 25 mosquito larvae and set the pan in a warm area, such as a protected or sunny area in a garage or house.

Observe these mosquito larvae every day and make a record of any changes you might observe. When did the first pupa appear? Did all larvae pupate at the same time? In what pan did pupae appear more rapidly? Did you see any adult mosquitoes emerge? Describe how they emerged. Do they emerge more rapidly in a warm or a cool area?

3. Will each insect eat only one kind of foliage (food)?

Locate some larvae on a plant. Carefully pick the larvae off without injuring them and place them on other plants. Watch them for about half an hour. Make a list of five plants on which these larvae will or will not feed. Keep some of these larvae in a cage or bottle with a screen cap for half a day without food. Now place them on some plants they refused to eat. Does it make any difference when they are hungry as to what they will eat?

4. Does temperature affect the rate of metamorphosis of flies?

Locate some fly maggots or larvae. Put equal numbers in two separate jars with some food in which you found them. Fifteen to 30 maggots is sufficient. Cover each jar with a screen cover or cap with a number of small holes. Place one jar in a warm, not hot, area. Place another jar in a cool area or in a refrigerator. Check every day for three weeks. Observe any changes and make a record of what you see. Did the temperature have any effect on these fly maggots?

5. What are the food needs of insects?

Many nutritional experiments can be performed using insects. These projects take more time. Stored-grain insects, such as saw-toothed grain beetles, meal moths and flour beetles, are very easy to raise. These insects will live until they use up all their food. Insects such as cockroaches, crickets and ants can also be used for nutritional experiments; however, the requirements to raise these insects in a jar are a little more exacting than for the stored-grain insects. The difference is that the food should be slightly moist. However, mold often becomes a problem in the culture and can kill the insects. This experiment can be performed with a wide variety of foods using different insects.

Place equal amounts of different grains, such as corn, oats, barley or wheat, in separate jars of the same size. Other foods, such as corn flakes, puffed wheat, puffed rice or bread can be used in this experiment. Place exactly the same amount of food material in each jar. Two cups of food will be sufficient for a good culture in a two-quart jar.

In each jar, place 10 or 20 stored-grain insects and cover the jars with a tight-fitting screen which is small enough so the insects cannot escape. Place the jars in an area so they do not become exposed to direct sunlight. All jars should be maintained in the same place and condition where it does not get too dry, too cold or too damp. Room temperature is ideal.

What food product was best for these insects? What food was least satisfactory? Were these insects able to live on all types of food? Answers to these questions can be determined by counting the number of insects in each jar. To simplify counting, the jar could be filled with alcohol or hot water to kill the insects.

6. Does the quantity of food affect growth rate and reproduction of insects? (Read Activity 5)

In the previously described experiment, different types of food were tried as a diet. In this experiment, another principle can be demonstrated using four or five separate quart jars with screen caps suitable for rearing insects. Place equal numbers of insects in each jar (about 15 or 20).

In one jar, place a small amount of food; in the second, place double the amount of food; in the third, place three times the amount; and in the fourth, place four times the amount of food. If stored-grain insects are used, a teaspoon of flour or cereal product would be sufficient for the first quart jar.

After two months, which jar contained the most insects? Why? How many more insects were found in the jar containing three times the amount of food?

Library Activities

1. What is the nature of the light of a glow worm or firefly?

Some insects produce light. Capture some of these insects on a warm evening. Place them in a small bottle and observe them in a dark room. Can you read by the light? In an encyclopedia or reference book, find out more about this light. Is the light warm or cold? Why is it of interest to scientists?

2. How much damage is done by some insects?

Insects do a tremendous amount of damage to food and fiber crops. In your library, look up how many dollars worth this damage amounts to in the United States? In your state? In your country? What insects caused this damage?

3. Must a certain insecticide be used for each pest?

Universities and the United States Department of Agriculture help producers of food by suggesting what insecticides can be used to control insects on specific crops or livestock. Make a list of crops grown in your area, the names of insects that attack each crop and the chemicals that can be used to protect the crop. Your County Extension Agent can help you find sources of information.

4. What information is available on labels of insecticides?

Visit a local agricultural supply store. Ask the

manager or owner for permission to make a list of different insecticides that are for sale and their use. Are the trade or brand names of each product the same? What different instructions are on a label? Are these different instructions found on other insecticide labels?

Collection Activities

1. What differences are there between insects in a flower garden and in a hayfield?

Collect insects in a hayfield and a flower garden on four different dates, such as in March, April, May and June. Select 10 different insects collected from each location, record the time you collect them, and mount them on insect pins. Keep them in your insect collecting box. Identify them according to the proper Order and label them.

Questions to be answered for this project. Where did you find the most kinds 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 most insects in the hayfields? Which insects were harmful and which were beneficial?

2. What differences are there between insects in a hayfield and those near lakes, rivers or ponds?

On four different dates, such as in March, April, May and June, collect as many insects as you can in and around lakes, rivers or ponds and compare them with what you can collect in a hayfield. Mount at least 10 different kinds of insects from each area. Keep them in your insect collection box. Identify and label them according to Order.

Where did you find the most kinds 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 most of the insects in the rivers, lakes or streams; in the hayfields?

3. Can insects be attracted with baits?

Obtain three 1-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 a third jar place one or two slices of bread. Moisten each jar with a little water.

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 species are you unable to name? Often, large numbers of one kind of insect will be found in bait traps. It will not be necessary to collect more than one or two specimens of each type. Identify and label them according to proper Order.

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

4. Do female moths attract males?

In the evening, place a female moth in a cage and observe at hourly intervals if males are attracted. Sex can be determined by antennae. Females have a thread-like antennae while males have many hairs or "bushy" antennae. Repeat with other species of moths. Can this knowledge be used for insect control?

5. Are insects attracted to light?

Place a light bulb on an extension cord about ten feet from a building. After dark, turn the light on and leave it burning for about one hour. Collect and mount 10 different insects you find around this light bulb at night. Compare them with the insects you collect during the daytime. Do this on four different dates, such as in May, June, July and August.

Identify and label these insects according to Order. Did you find the same kinds of insects in the daytime as you did at night around the light bulb? 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?

6. Are insects attracted to 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 25 feet from another bulb. After dark, turn the lights on for about one 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, such as 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 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 and label them according to Order.

7. Make a collection of cocoons or chrysalises (four or more).

How many different kinds can you find? Place each one in a separate jar or can with a cover. Place a twig or branch in the can for the adult to crawl on. After the moths or butterflies emerge, mount both the adult and cocoon for display purposes. Make a display of four or more cocoons or chrysalises and emerged moths or butterflies.

8. Make a collection of different types of injury insects have caused to bark or wood of trees or shrubs.

Mount these for display.

9. Make a collection of three or more nest-building insects.

These can be mounted for display. When collecting certain bees and wasps, be sure to take precautions to avoid being stung. Insect stings can be painful and are dangerous to some people.

10. Collect ten or more colorful insects.

How many different colors and shades can you find? These can be mounted for display.

11. Make a display of insect parts.

Collect 25 large insects and remove the wings with scissors or forceps, being careful not to break the insect wing. With fast-drying glue, insect wings can be mounted on a white piece of cardboard. An attractive and colorful display can be made, illustrating the great variation in insect wings.

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

The eggs can be mounted on cardboard with fast-drying glue or preserved in a small bottle of 70% alcohol. Also preserve the larvae in small bottles of 70% alcohol. The pupae or nymphs and adults can be mounted on insect pins or glued directly to hard cardboard. In a library, look up more information about the life cycle of the insect you have mounted.

How long does it take 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 into an adult?

Management Activities

1. Study an insect control-management program on one or more of the following: corn, small grains, legumes, cotton, tobacco, vegetables, fruits, trees and shrubs (ornamentals), stored food products, domestic animals, or lawns.

It may not be possible to do the work yourself. This activity can be completed by closely observing and interviewing trained operators using chemical or nonchemical methods for insect management practices.

a. What insects were causing damage?
b. What types of damage were the insects causing?
c. What consideration was given to determine whether or not to apply control methods?
d. What insecticide or insecticides were used? If no insecticide was used, what other method was applied?
e. In what form was the insecticide being applied (liquid? dust? powder? granules?)?
f. What type of equipment was being used? Include all equipment in addition to the sprayer.
g. How much insecticide was used and how much did it cost?
h. What materials were put in the spray tank besides the insecticide?
i. What safety precautions and safety equipment did the trained operator use when performing this work?
j. What precautions must be observed in storing the insecticide? In mixing the insecticide?
k. What precautions need to be taken in using the insecticide to prevent:
   - objectionable residues from getting on food or food crops?
   - poisoning of birds, animals, fish and other beneficial forms of life?
   - pollution of air, soil and water?
l. What could have happened if no control methods had been used?
m. What was the estimated savings in dollars by having applied a control method?
n. What follow-up activities (maintenance and surveillance) were performed to prevent a reccurrence of this problem?

2. Study a community-wide mosquito control program.

This project can best be carried out where a city applies control practices for mosquitoes during the summer months.

a. What community officials, groups or organizations were involved in planning and organizing the program?
b. How were funds obtained to carry out this program?
c. What methods of communication were used to inform people as to what was happening?
d. What were the assigned duties of individuals running the program?
e. What were the citizens asked to do to help in carrying out the community effort?
f. Where were the mosquito breeding grounds in relation to the problem area?
g. What chemical and non-chemical practices were performed?
h. Were the practices for larval or adult control?
i. How often were the practices performed?
j. What safety precautions were taken for protection of:
   - personnel while performing their duties?
   - local citizens?
   - birds, animals, fish and other beneficial forms of life?
   - air, soil and water?
k. What follow-up activities (maintenance and surveillance) were performed to prevent a reccurrence of this problem?

3. Plan your own research or experiment on some problem relating to insect control, such as control of household or house plant pests.

Natural Insect Control and Management

Insects can be controlled by natural causes. Many insects cannot live where it is too cold, wet, dry or hot. Wind and soil conditions play an important part in insect management. Earth formations, such as mountains, hills, rivers and lakes, prevent insects from moving from one area to another. Natural enemies, such as birds, animals and other insects, help control insect pests.

Control of Insects by Climate

Very few insects can live where it is extremely cold. In the Arctic regions, great numbers of mosquitoes and flies occur during the brief summers. During the major part of the year when it is very cold, these insects remain dormant. On the other hand, very few insects can live where the climate is hot and dry. Only a few species of insects have become adapted to desert life.

Wind movement is also of great importance. Many of the smaller and more frail insects, which normally fly for great distances, are unable to leave the ground during strong winds. If they do take flight, they are so beaten by the wind that they soon die.

Control of Insects by Earth Formations

Large bodies of water, such as oceans, are natural barriers to the spread of nearly all insects. Certain insects that cannot fly are stopped in their movement by lakes or streams. They depend on man or other animals to get across such barriers. Mountain ranges are also effective barriers to the spread of insects and offer varying conditions of climate through which many insects cannot pass. The Colorado potato beetle began spreading from Colorado to the east around the year 1859 and reached the Atlantic Coast in 15 years; it was more than 50 years crossing the Rocky Mountains.

The type of soil can restrict or allow certain insects to live in a region. Many insects spend part or all of their lives in the soil and must move around in the soil to feed. Too thick and heavy a soil restricts movement. Many plants upon which insects feed cannot live in certain soils, thus restricting insects.

Control of Insects by Natural Enemies

Many insects eat other insects. It would be difficult to produce crops in most regions of the earth if beneficial insects were not present to keep down plant-feeding insects.

Birds eat many insects. Some birds eat enough insects in one day to equal the bird's weight. Some birds, such as robins and mockingbirds, eat insects mainly during the summer when this food is most abundant. Others, such as woodpeckers and creepers, exist largely on an insect diet throughout the year. Most birds earn many times over the value of fruit and berries they take from gardens and orchards. For this reason, we must protect birds, not only against firearms, but also against the cat, which is the bird's worst domestic enemy.

Many small animals, such as moles and skunks, depend on insects for food. Some snakes and salamanders exist largely on an insect diet. In 24 hours, the toad eats an amount of insects equal to about four times its stomach capacity.

Legal Control

Legal control on insects is done by controlling human activities. Control is accomplished by enforcing inspection and quarantine laws. Quarantine and inspection activities help prevent the entry of harmful pests from foreign countries and have stopped the spread of pests within this country.

Questions

1. Name four ways in which climate helps to control insects.
2. How does wind affect insect movement?
3. How do large bodies of water help control insects?
4. Why should we protect birds?
5. Why would thick clay soils be a control for insects?
6. How do high hills and mountains help to prevent insect movement?

Demonstrations or Illustrated Talks

Demonstrations give you the opportunity to show how to work with insects. Illustrated talks give you the opportunity to tell about insects. Damage or beneficial work done by an insect, its life cycle, where it lives, its feeding habits and methods of control are major points which can be developed in a 4-H Entomology demonstration or illustrated talk.

Diagrams, posters or charts help illustrate points for emphasis. This material should be kept out of sight when not in use. Summarize by reviewing all the important points.

It is important to study all available subject matter beforehand, so you will be prepared to answer questions after your demonstration or talk. Visit with your local leader or County Extension Agent for suggested topics and sources of information.

PROJECT ACCOMPLISHMENTS

Answer questions completely:

1. Did you make a glass-top display case? _____

2. Did you make a relaxing jar? _____

3. Did you rear a beneficial insect? _____

4. Did you rear a pest insect? _____

5. How many different insect species did you collect and mount for this project? _____

6. How many Orders do you have in your collection? _____

INSECT ACTIVITY REPORT

Kind of Activity (observation, experimental, library, etc.) _____

Activity Number _____

Use one sheet for each activity completed.

1. Statement of problem under study _____

2. How did you proceed? What did you do? _____

3. What were your observations? _____

4. What are your conclusions — what did you discover? _____

List the things you have learned in your project, and any interesting experiences.

1. List your goals for your entomology project this year.

2. List new things you learned in this project.

3. List your most important accomplishments in your project this year.

4. List demonstrations, appearances, exhibits, articles written, tours, workshops, camps and field trips that you participated in through this project.

5. List awards and recognitions received in this project.

6. List your leadership participation in this project.

7. List what your club or group did in this project.

8. List your citizenship and community service experiences in this project.

9. List your experiences in other 4-H activities.

10. List 4-H leadership experiences.

11. List 4-H citizenship and community service experiences.

12. List your non-4-H experiences in school, church, and community.

DEMONSTRATIONS OR ILLUSTRATED TALKS I HAVE GIVEN

Topic	Where Given

EXHIBIT RECORD

What was Exhibited	Where Exhibited

HELP I RECEIVED

Name of person(s) _____

_____

Name of circular(s) _____

_____

Name of book(s) _____

_____

RECORD OF INSECTS COLLECTED

	COMMON NAME (Tiger Beetle, Stink Bug, etc.)	ORDER	COLLECTED FROM (plant or animal host or other place)	LOCALITY (nearest town and county)	COLLECTION DATE	IMPORTANCE TO MAN			NUMBER OF WINGS			KIND OF MOUTH PARTS		
						Bene-ficial	Harm-ful	Doubt-ful	0	2	4	Chew-ing	Suck-ing	Lap-ping
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														

(Add additional sheets as needed.)

RECORD OF INSECTS COLLECTED

	COMMON NAME (Tiger Beetle, Stink Bug, etc.)	ORDER	COLLECTED FROM (plant or animal host or other place)	LOCALITY (nearest town and county)	COLLECTION DATE	IMPORTANCE TO MAN			NUMBER OF WINGS			KIND OF MOUTH PARTS		
						Bene-ficial	Harm-ful	Doubt-ful	0	2	4	Chew-ing	Suck-ing	Lap-ping
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														

(Add additional sheets as needed.)

CUT-OUT LABELS FOR YOUR COLLECTION

EXAMPLE:

ALACHUA CO. FLA. 2-3 1968 R. STRAYER	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	THYSANURA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	COLLEMBOLA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	ORTHOPTERA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	ISOPTERA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	NEUROPTERA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	EPHEMOPTERA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	ODONATA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	PLECOPTERA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	CORRODENTIA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	ANOPLURA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	MALLOPHAGA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	THYSANOPTERA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	HEMIPTERA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	LA. CO. 19__	FLA. CO. 19__	HOMOPTERA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	DERMAPTERA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	COLEOPTERA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	STREPSIPTERA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	MECOPTERA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	TRICHOPTERA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	LEPIDOPTERA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	DIPTERA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	HYMENOPTERA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	SIPHONAPTERA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	PROTURA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	EMBIOPTERA
FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	FLA. CO. 19__	ZORAPTERA

CUT-OUT LABELS FOR YOUR COLLECTION

EXAMPLE:

ALACHUA CO. FLA. 2-3 1968 R. STRAYER	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	THYSANURA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	COLLEMBOLA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	ORTHOPTERA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	ISOPTERA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	NEUROPTERA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	EPHEMOPTERA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	ODONATA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	PLECOPTERA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	CORRODENTIA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	ANOPLURA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	MALLOPHAGA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	THYSANOPTERA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	HEMIPTERA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	HOMOPTERA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	DERMAPTERA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	COLEOPTERA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	STREPSIPTERA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	MECOPTERA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	TRICHOPTERA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	LEPIDOPTERA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	DIPTERA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	HYMENOPTERA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	SIPHONAPTERA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	PROTURA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	EMBIOPTERA
FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	FLA. CO. 19___	ZORAPTERA

1. This document is 4HENM12 of the Florida 4-H Youth Development Program, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Reviewed June 2002. Please visit the EDIS website at http://edis.ifas.ufl.edu.

2. P.G. Koehler and J.C. Northrop. Publication contact: Nancy Johnson, 4-H Publication Coordinator, Department of Family, Youth and Community Sciences, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville 32611.