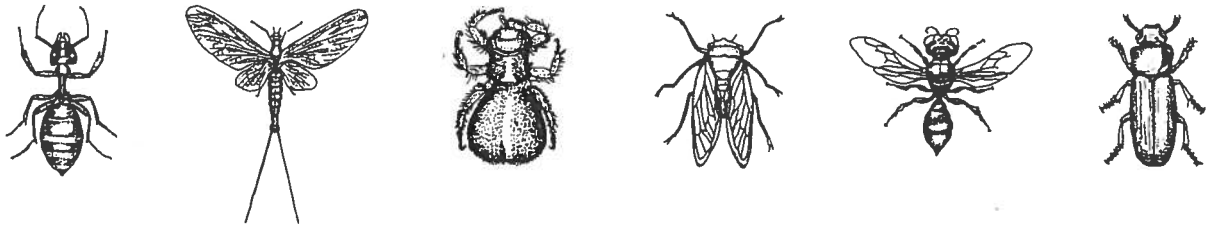
Adventures with Insects



Circular 4-H 142

UNIVERSITY of WISCONSIN Extension Service
College of Agriculture, Madison

project REQUIREMENTS

10-11 year old members should complete:

1. 3 observational activities
2. 1 experimental or library activity
3. 1 collection activity--20 different insects--be sure to study how to collect and mount insects

12-14 year old members should complete:

1. 3 or more observational activities
2. 1 experimental activity
3. 1 library activity
4. 2 collection activities--20 insects in each activity
5. 1 insect control activity

Members 15 years and older should complete:

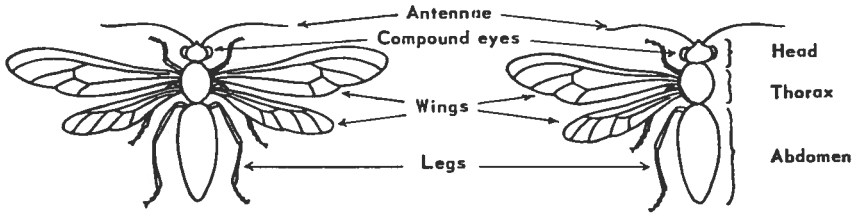
1. 2 observational activities
2. 1 experimental activity
3. 1 library activity
4. 3 collection activities--20 insects in each activity
5. 2 control activities
6. Think up your own research problem. This can substitute for any one of above requirements

Before you begin your project, be sure to read pages 4 through 13 on Optional Activities.

insect CHARACTERISTICS

Everyone readily recognizes flies, mosquitoes and butterflies as insects. What about such animals as spiders, centipedes, mites and crabs? Are they insects? No, they are not. The characteristics shown in the diagram and illustration will help you distinguish insects from their close relatives.

	INSECTS	SPIDERS	MILLIPEDES (thousand-legged worms)	CRAWFISH
	3 body divisions	2 body divisions	2 distinct body divisions	2 body divisions
	3 pairs of legs	4 pairs of legs	2 pairs of legs to each segment of body (100 or more legs)	5 pairs of legs
	1 pair of antennae	no antennae	1 pair of antennae (as do insects)	2 pairs of antennae
	2 pairs of wings (usually)	no wings	no wings	no wings



SKETCH OF AN INSECT SHOWING BODY PARTS

All insects in their adult form have:

1. A body divided into three parts
2. Three pair of legs
3. A head with usually one pair of antennae and a pair of eyes (there are exceptions to these two characteristics)
4. Two pairs of wings (wings are absent in many insects such as lice, fleas, ants)

insects
CHANGE FORM

Insects go through changes after they hatch from eggs. The changes or stages they pass through after hatching is called metamorphosis.

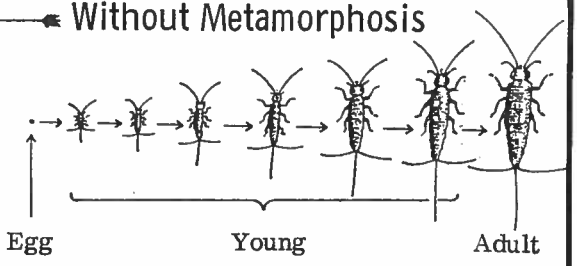
Therefore, insects differ in their method of development. Do any other animals go through a similar type of development?

Check the drawings and notice differences in types of metamorphosis or changes in the life cycles of insects.

METAMORPHOSIS OF VARIOUS INSECTS

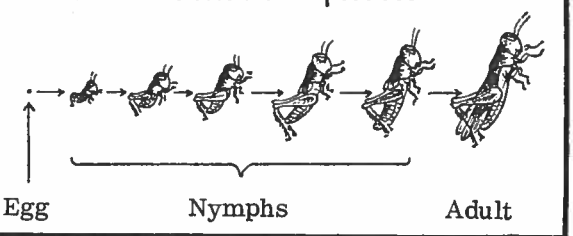
Without Metamorphosis

Examples	Orders
Silverfish	Thysanura
Springtail	Collembola
Chewing Lice	Mallophaga
Sucking Lice	Anoplura



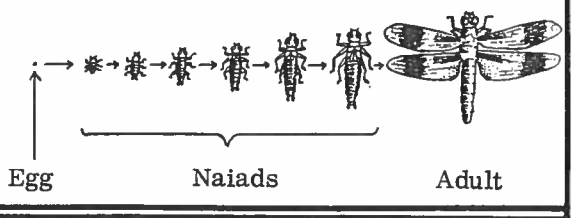
Gradual Metamorphosis

Examples	Orders
Grasshoppers	Orthoptera
Termites	Isoptera
Booklice	Corrodentia
Thrips	Thysanoptera
True Bugs	Hemiptera
Aphids	Homoptera
Earwigs	Dermaptera



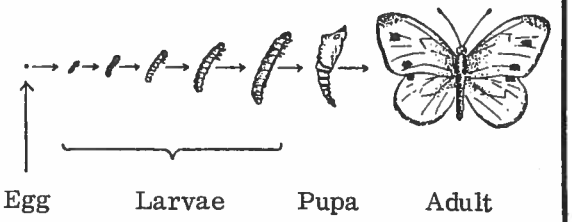
Incomplete Metamorphosis

Examples	Orders
May Flies	Ephemerida
Dragon Flies	Odonata
Store Flies	Plecoptera



Complete Metamorphosis

Examples	Orders
Lacewing	Neuroptera
Beetles	Coleoptera
Scorpion Fly	Mecoptera
Coddisfly	Trichoptera
Moths, Butterflies	Lepidoptera
Flies	Diptera
Fleas	Siphonaptera
Wasps, Bees	Hymenoptera



optional ACTIVITIES

Following are activities for the insect study project. Information on each activity should be recorded in your project record. You should include:

...the kind and number of the activity chosen
...statement of the problem
...what you did
...what you observed
...the results, such as:
    your conclusions
    what you learned
    why is the knowledge important
    answers to questions stated in activity

OBSERVATION activities

I. 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?

II. 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 per cent of the material found in the stomach that consisted of insects or insect parts for each species of fish.

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

Find nests of two different types of birds such as bluebirds, wrens, phoebes, catbirds, etc., 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 you have them available and also try to remain hidden from sight of the birds. What kind of food did the parents feed their young for each specie of birds?

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

During a summer evening (twilight) watch two different birds in flight for half an hour such as swallows, night hawks, purple martens, chimney swifts, etc. 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?

V. 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 careful 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 like a ladybird beetle, cricket or ground beetle and place it inside the jar with the spider. What happened?

VI. Do certain insects eat other insects? Can ladybird 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 fifteen minutes? Will this insect feeding on aphids eat other insects such as moths, crickets, flies? Place several ladybird beetles on a plant with aphids. A couple days later observe if aphids are disappearing.

VII. Observe dragon flies or damsel flies. What is the food of a dragon fly or damsel fly?

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?

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

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

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

- ...looks like a twig (What happens when larvae is disturbed? Left alone?)
- ...looks like the bark of tree
- ...is green like leaves of plants
- ...have spots that look like eyes of larger animals
- ...are the color of the flowers you found them on

How do these traits aid these insects?

X. Do communal insects each have special jobs?

Observe insects that work together like bees, ants and termites. Do they fight among themselves for feed or space? Do they all do the same thing or have the same kind of job?

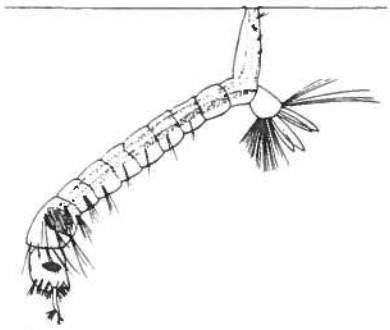
Drop an ant from another colony into the group. Is it accepted? Drop some other insects into the group. What happens? Try particles of food and observe result.

EXPERIMENTAL activities

I. 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.

In the first jar place a small minnow or goldfish. 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?



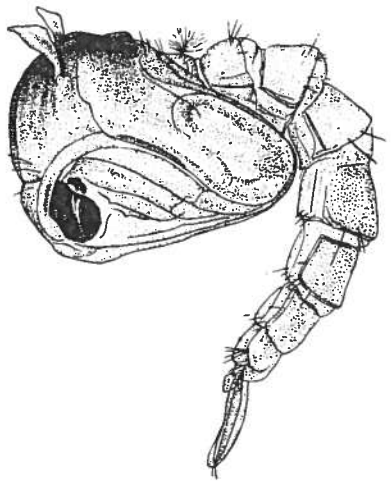
Mosquito larvae (wriggler) breathing through air tube at water surface (greatly enlarged).

II. Does temperature of water 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 twenty-five 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 that you captured the mosquito larvae. Place this pan of water in a cool area such as a basement or shaded corner of a garage.

In another pan place another twenty-five mosquito larvae in a warm area such as a protected or sunny area in a garage or house.

Observe these pans with mosquito larvae every day and make a record of any changes that you might observe taking place. The illustrations will help you recognize mosquito pupae. When was the first pupae formed? Did all larva pupate at the same time? In what pan did pupae form 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?



Pupa of the mosquito that transmits yellow fever (greatly enlarged).

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

Locate some worms on a cabbage plant. Carefully pick them off without injuring them and place them on plants other than cabbage. Watch them for about half an hour.

Make a list of five plants on which these worms feed, and on which they will not feed. Keep some of these worms 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?

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

Locate some fly maggots or larvae. Put equal numbers in two separate jars with a little of the kind of food in which you found them. Fifteen to thirty maggots are sufficient.

Cover each jar with a screen cover or cap with a number of small holes. Place one jar in a warm area, but not hot. Place another jar in a cool area or if possible, in a refrigerator. Check every day for three weeks. Observe any changes and make a record of what you saw. Did the temperature have any effect on these fly maggots?

V. What are the food needs of insects?

Many nutritional experiments can be performed using insects. These projects are a little longer. The results can be extremely interesting and educational. Stored grain insects such as the saw-tooth grain beetle or meal moths and flour beetles are very easy to raise in a culture. All that is necessary is to obtain some insects, place them in a jar with some grain, cover it with wire mesh so they don't escape and place the jar in an area where it does not get too dry, too cold or too damp. Room temperature is ideal. These insects will live in this bottle until they use up all their food. Insects such as cockroaches, crickets and ants may also be used for nutritional experiments; however, the requirements to raise these insects in a bottle or jar are a little more exacting than for the stored grain insects. The difference here is that the food for these insects should be a little moist. Mold often becomes a problem in the culture, however, and will kill all of the insects. If a person has the facilities and interest to rear cockroaches or crickets, many interesting experiments can be performed with them. One such simple experiment is described below.

Place equal amounts of different grains such as corn, oats, barley or wheat in separate bottles all of the same size. Other foods such as corn flakes, puffed wheat, puffed rice or bread can also be used in this experiment. The important thing to do here is to place exactly the same amount of food material in each jar. Two cups of food would be sufficient for a good culture in a two-quart jar. In each jar, place ten or twenty stored grain insects such as the saw-tooth grain beetle and cover the jars with a tight-fitting screen which is small enough so the insects do not escape. Place all these jars in one area so that they do not become exposed to the direct sunlight. All the jars should be maintained in the same place and condition.

Questions to be answered from this experiment.

1. What food product was best for these insects?
2. What food was least satisfactory?
3. Were these insects able to live on all types of food you provided?

Answers to these questions can be determined by counting the number of insects in each jar. To simplify counting the insects, the jar could be filled with alcohol or even hot water to kill the insects; then count them.

This same experiment can be performed with a wide variety of different foods using a variety of different insects.

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

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 jars with screen caps that are suitable for rearing insects, placing equal numbers of insects in each. Select fifteen or twenty for each bottle. Make sure you have exactly the same number in each jar.

In one jar place a small amount of food. In the second jar, 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 you are using stored product insects such as meal moths or grain beetles, a teaspoon of flour or cereal product would be sufficient for the first jar, two teaspoons for the second, etc., if you use a quart size 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? An easy to count method is to place either hot water or alcohol in each jar and kill the insects.

IV. 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 he has for sale and their use. Are the trade or brand names of each product the same?

LIBRARY activities

I. What is the nature of the light of a glowworm 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 library book find out more about this light. Is the light warm or cold? Why is it of interest to scientists?

II. 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 of damage this amounts to in the United States? In Wisconsin? In your county?

III. Must a certain insecticide be used for each insect pest?

The University and 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 agent can help you find sources of information.

COLLECTION activities

I. What differences are there between insects in a flower garden and in a hayfield (clover or alfalfa)? (Read directions on collecting insects before you begin. An insect collecting net is very helpful but not necessary.)

Collect insects in a hayfield and a flower garden on four different dates, such as in May, June, July and August. Select ten 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 the proper order (see page 19) and label them accordingly.

Questions to be answered from this project.

1. Where did you find the most kinds of insects, in flower gardens or hayfields?

2. Where did you find the most colorful insects, in the flower gardens or hayfields?

3. Did you find the same kinds of insects on the different dates? (May, June, July, August, September, etc.)

4. What month did you find the most insects in the hayfields? What month did you find the most insects in a flower garden?

5. Which insects were harmful and which were beneficial?

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

Collect as many insects as you can in and around lakes, rivers or ponds at four different times in the summer and compare those with what you can collect in a clover or an alfalfa field on four different dates such as May, June, July and August. Mount at least ten different kinds of these insects from each area and keep them in your insect collection box. Identify them according to order (see page 19) and label them correctly.

Questions to be answered from this project.

1. Where did you find the most kinds of insects?

2. Where did you find the most colorful insects?

3. Did you find the same kinds of insects on the different dates? (May, June, July, August, September, etc.)

4. What month did you find most of the insects in the rivers, lakes, or streams; in the hayfields?

III. 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. In one jar place some raw meat such as a small amount of raw hamburger. In another, place some ripe fruit such as cantaloupe or watermelon rinds, apples, or peaches, and in a third jar place one or two slices of bread. Moisten each of these with a little water. Make sure that these jars are placed in such a manner that small animals or dogs cannot disturb them. Collect as many different kinds of insects as you can from each of these jars one day after placing these jars out, three days after placing these jars out, and one week after placing these jars out. How many insects did you attract? Make a list of insects you can name. How many species are you unable to name?

In bait traps often large numbers of one kind of insect will be found. It will not be necessary to collect more than one or two specimens of each type you find. Identify them according to their proper order (see page 19) and label them accordingly.

Questions to be answered from this project.

1. What bottle attracted the most insects?

2. Are all the insects in each bottle the same?

3. 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?

IV. 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 the antennae of males has many hairs or is "bushy". Repeat with other species of moths. Can this knowledge be used for insect control?

V. Are insects attracted to light?

Place a light bulb on an extension cord out in the open, as a lawn or backyard, about ten feet from a building. After dark, turn the light on and leave it burning for about one hour. Collect and mount ten different insects you find around this light bulb at night, and compare them with the insects you collect during the daytime. Do this at least on four different dates such as May, June, July, August. Identify these insects according to order (see page 19) and label them accordingly.

Questions to be answered from this project.

1. Did you find the same kinds of insects in the daytime as you did at night around a light bulb?

2. When did you collect the most colorful insects, in the daytime or at night?

3. Did you find different kinds of insects during the different months?

VI. Are insects attracted to colored light bulbs?

Place red, blue, yellow and white light bulbs on extension cords out in the open about ten feet from a building. Each different colored light bulb should be at least twenty-five feet from another bulb. After dark turn the lights on and leave burning for about one hour. Collect and mount as many different insects as you find around each light bulb. Be sure to keep a record of what insects you found around each colored light bulb.

Questions to be answered from this project.

1. What color was most attractive to insects at night? Least?

2. Were any of the insects more colorful than others?

3. Did you find the same kind of insects around each of the different colored light bulbs?

4. Did you find the same kind of insects around these different colored light bulbs in May, June, July, August or September?

5. Mount at least ten insects from each group on insect pins. These may be used for display purposes should you so desire. Identify them according to proper order (see page 19) and label them accordingly.

VII. Make a collection of different types of injury insects have caused to plants. A display should consist of at least four different types of plants. Before making your collection be sure to read and study the procedure used to collect, press and mount plants (see pages 21, 22 and 23).

VIII. Make a collection of different types of injury insects have done to bark or wood of trees or shrubs. Mount these for display purposes.

IX. 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. After the moths or butterflies emerge, mount both the moth and cocoon for display purposes. Make a display of four or more cocoons or chrysalises and emerging moths or butterflies.

X. Make a collection of three or more nest building insects. These can be mounted for display purposes. When collecting certain bees and wasps, be sure to take precautions to avoid sting. Insect stings can be painful and dangerous.

XI. Collect ten or more colorful insects. How many different colors and shades of colors can you find? These can be mounted for displays of various types.

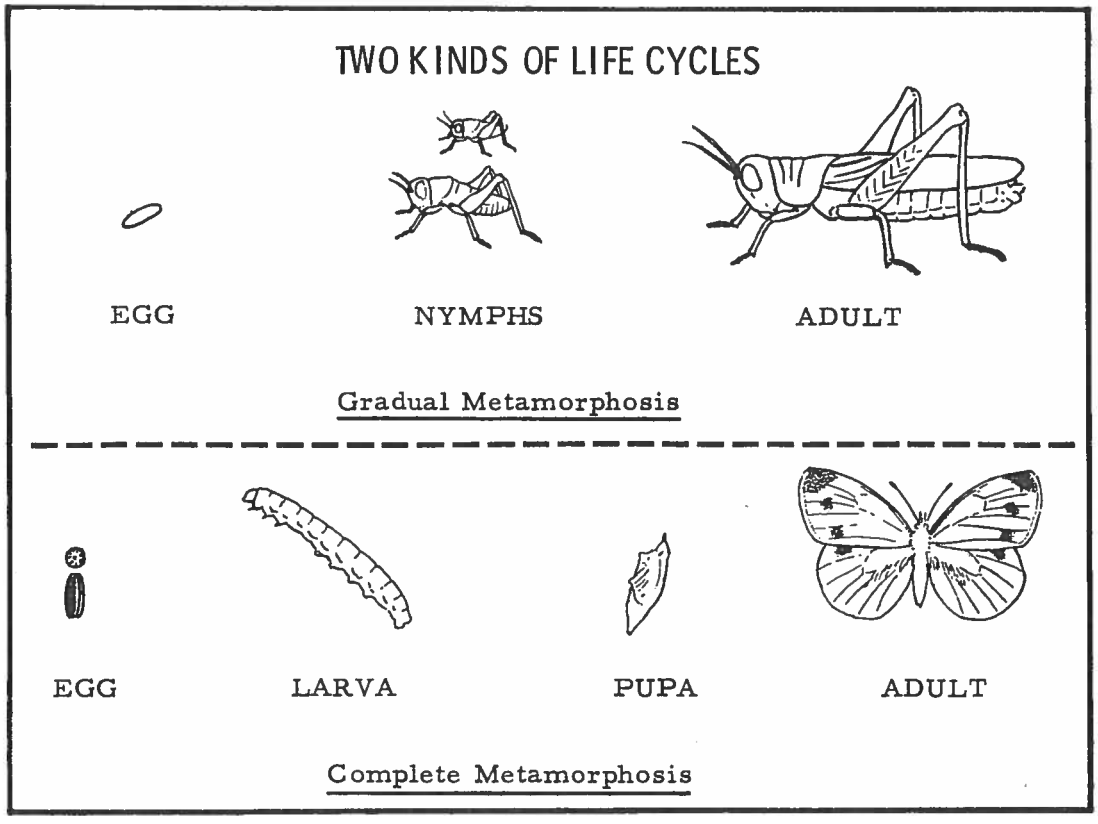
XII. Make a display of insect parts. Collect 25 large insects, remove the wings with a scissors or forceps, being careful not to break the insect wing. With fast drying glue these insect wings can be mounted on a white piece of cardboard. A rather attractive and colorful display can be made illustrating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

XIII. Show the life cycle of an insect by finding eggs, larvae, pupae and adults of the same kind of insect.

The eggs could be mounted on cardboard with some fast drying glue or preserved in a small bottle with rubbing alcohol. It is best to preserve the larvae (see directions on page 18) in small bottles of alcohol. The pupae and adults can be mounted on insect pins or glued direct to hard cardboard. In a library look up more information about the life cycle of the insect you have mounted.

Questions to be answered from this project.

1. How long does it take for the eggs to hatch?
2. How many eggs does this insect lay?
3. What does this larvae feed upon?
4. How long does it take the larvae to develop into a pupa?
5. How long does it take the pupa to emerge into an adult?



CONTROL activities

I. Objective: To control insects in a vegetable garden.

Find some insects that are doing damage to some vegetables in a garden. Usually cabbage, beans or tomatoes have economically damaging insect populations; however, any fruit may at times be attacked by insects. Apply the appropriate controls.

Questions to be answered.

1. What insects were damaging the plants?
2. What type of damage were they doing--chewing? Sucking?
3. What insecticide did you use to control this insect?
4. How much material did you use?
5. How long did you have to wait before you could harvest the crop after applying the insecticide?
6. What precautions did you observe when using the insecticide?
4. In what form was this insecticide purchased? (Liquid, powder or granular)
5. What per cent of active ingredients are there? What price did he pay for this insecticide?
6. How was this material being applied?
7. What precautions need to be taken in using the material to prevent:
   a. objectionable residues from getting on food crops?
   b. killing or poisoning of birds, animals and beneficial insects?
   c. pollution of the soil, rivers and lakes?
8. What precautions must be observed in:
   a. storing the insecticide?
   b. mixing the insecticide?
9. Supposing the grower did not control these insects, what per cent of the crop would be lost? What is the dollar value of the crop he would have lost?

II. Objective: To study control of insects on field crops such as corn, alfalfa, field peas or beans.

It might not be possible for you to do the work yourself but this activity can be completed by closely observing and interviewing a trained operator when he does the spraying.

Questions to be answered.

1. What insects were damaging the crop?
2. What type of damage were these insects doing?
3. What insecticide was being used?

III. Objective: To control insects on animals.

Find some animals that are being pestered or attacked by insects such as flies, mosquitoes, lice or fleas. Apply the appropriate controls.

Questions to be answered.

1. What insects were attacking the animal?
2. What insecticides did you use to control this insect?

3. How did you apply the insecticide?

4. What precautions did you exercise in applying the control?

5. What other insects will this insecticide control?

8. What precautions must be observed in:

   a. storing the insecticide?

   b. mixing the insecticide?

9. Are other materials put in the spray tank besides the insecticides?

10. What could happen if the fruit were not sprayed with an insecticide?

IV. Objective: To study the control of insects on fruit crops.

It might not be possible for you to do the work yourself, but this activity can be completed by closely observing and interviewing trained operators when they are doing the spraying.

Questions to be answered.

1. What insects attack the crop?

2. Did growers wait until the fruit was attacked or did they apply sprays to prevent insect damage?

3. What insecticide or insecticides did they use during the growing season?

4. In what forms are the insecticides purchased? Liquids? Dust? Powder?

5. What per cent active ingredient does the material contain?

6. How was the material applied? How much is used per acre or per tree? How much does it cost?

7. What precautions need to be taken in using the material to prevent:

   a. objectionable residues from getting on the fruit?

   b. killing or poisoning of birds, animals and beneficial insects?

   c. pollution of the soil, rivers and lakes?

V. Plan your own research or experiment on some problem relating to insect control.

CAREERS activities

Read section on Consider these Careers, pages 23 and 24.

I. Interview a professional entomologist. Ask him the following questions:

   1. How many years of study did it take him to be an entomologist?

   2. What got him interested in entomology?

   3. How old was he when he first became interested in the study of entomology?

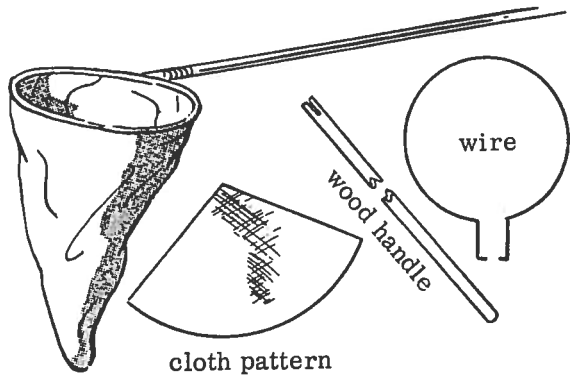
   4. Briefly describe the type of work this entomologist is doing.

II. In a library find additional information on careers in entomology. Write a special report on a career in entomology not specifically covered in this booklet.

COLLECT AND MOUNT your insects

Insect collecting can be an interesting and educational experience. The collection itself can be a useful reference similar to a library or a work of art depending on the individual's objective.

Before beginning a collection, the entire directions for collecting and mounting insects should be read. Simple mistakes can thus be avoided.



Insect Collecting Net

make a COLLECTING NET

You can collect many insects by picking them up from plants, looking under logs, etc. However, a net is needed to collect many flying insects or to collect insects from plants such as alfalfa, flowers, potatoes, etc.

To make a general purpose net, you will need:

1. A handle about three feet long (a broom handle will work very well).
2. About five feet of stiff wire.
3. A piece of unbleached muslin, nylon, or similar material about 3 x 5 feet for a net bag.

Bend the wire into a hoop about 12-15 inches in diameter. Bend the ends out as shown in the illustration. Then cut the grooves and drill holes in the end of the handle, so that the hoop will fit into them. Cut the cloth from the pattern to make a bag of 12-15 inches in diameter and 18-24 inches deep. Sew a hem of 1-1 1/2 inches wide at the top and sew the edges to make a bag. Slip the bag into the wire hoop and fasten the hoop to the handle with fine wire or a clamp.

It is often times desirable to make two insect nets. One for collecting insects in hayfields, woods, etc. and the other net for use in collecting aerial insects such as butterflies, wasps, dragonflies, etc. This latter type of insect net should be lightweight and porous, so that it can be swung rapidly and freely through the air, whereas the insect net used to collect insects in hayfields should be of a heavier and more durable type of frame and cloth. Insect collecting nets may also be purchased at biological supply houses listed in the back of this circular.

make a KILLING JAR

In order to collect insects, an insect-killing jar is very helpful. The materials required to make an insect-killing jar are:

1. A wide-mouth jar or bottle with a tight-fitting cover; a peanut butter jar or a large size baby food jar are very good.
2. Some pieces of rubber cut into small pieces about 1/2 inch square.
3. Some heavy paper or cardboard.

4. Some killing fluid such as:

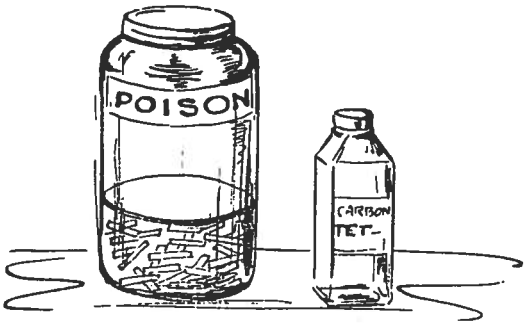
   a. chloroform

   b. carbon tetrachloride

   c. dry cleaning fluid

   d. ethyl acetate

Chloroform is probably the best although the others are satisfactory. You can purchase any one of these products in a drugstore. In order to make your killing jar, place the pieces of rubber in the bottom of the jar and pour in about a teaspoon of killing fluid. Remember to keep your killing fluid bottle tightly covered. After the rubber absorbs the killing fluid, place the piece of cardboard or heavy paper over the pieces of rubber and press it tightly into place. This holds the rubber pieces in the bottom of the jar. Put the cover on your killing jar. Your killing jar is now ready to use.



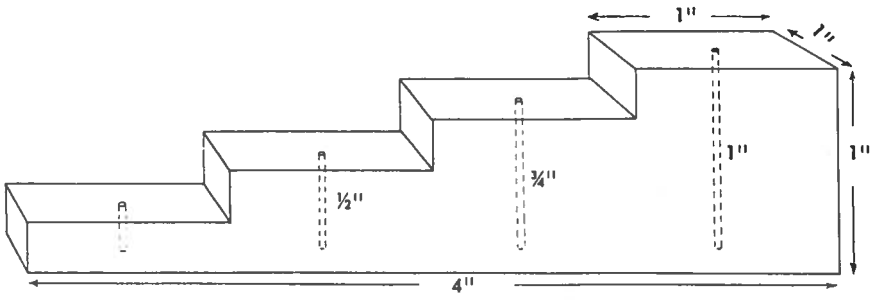
Insect Killing Jar with Killing Fluid

REMEMBER, THE FUMES ARE POISONOUS. Do not breathe them. When the fumes become weak and no longer kill insects rapidly, recharge your bottle by adding a small amount of killing fluid. The killing fluid can be poured down the side of the jar without removing the cardboard and rubber pieces. Keep your killing jar closed at all times.

You can also make a killing jar by using plaster of Paris. Pour in the jar about one inch of plaster of Paris and let it dry. After it is dry, pour your killing fluid on the dried plaster of Paris. Pour in only the amount that will be absorbed by the plaster of Paris. When your killing jar becomes weak, recharge it again with your killing fluid.

MOUNT your specimens

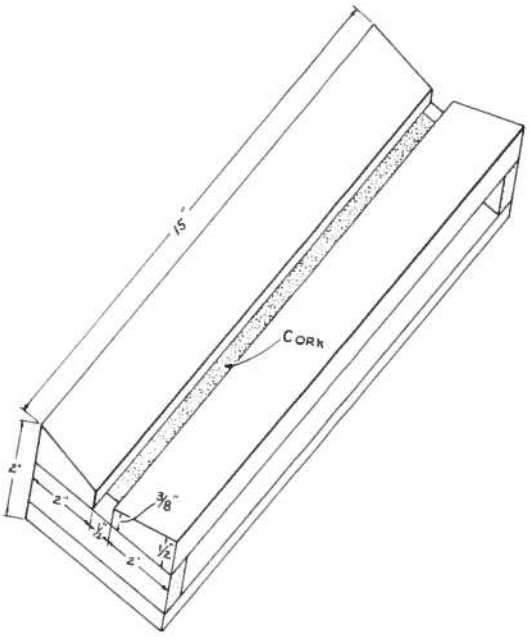
To make an insect collection appear neat and orderly, it is desirable to mount all of them at the same height on the pin. To do this, it is desirable to use a pinning block. The illustration shows you how to make a very simple one.



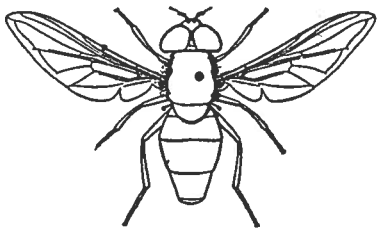
A Pinning Block

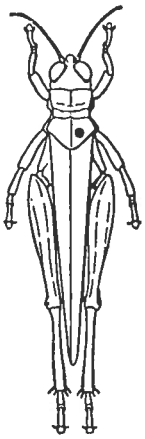
Insects should be mounted when they are still fresh because once dried out they become brittle and easily broken. They should be mounted on special insect pins so they can be handled without breaking. Common stick pins are not suitable because they are too thick and too short. Insect pins can be ordered from biological supply houses. Addresses are listed in the back of the booklet. Most insects are pinned through the thorax (middle section of the body). On beetles the pin is placed through the right wing. Very small insects can be mounted on small paper triangles or card points. The insect is put on the tip of the triangle with a small drop of fast-drying glue. The paper point is then put on the pin.

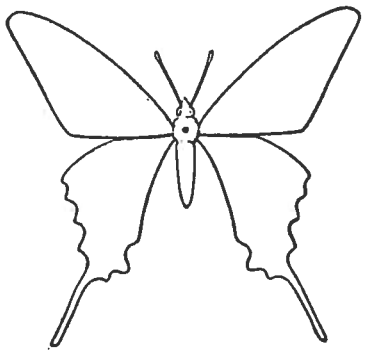
Moths, butterflies and skippers add interest and color to every collection. Unless these insects are properly mounted they are useless in a collection. The wings must be spread properly in order to see the color pattern. Spreading boards for this purpose may be purchased at biological supply houses or made at home. The drawing below will give you an idea of how to make one.

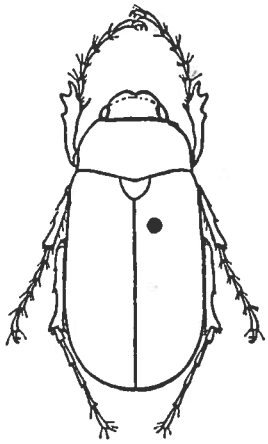


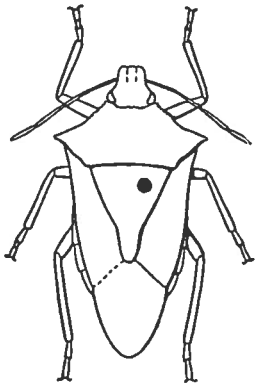
Insect Spreading Board



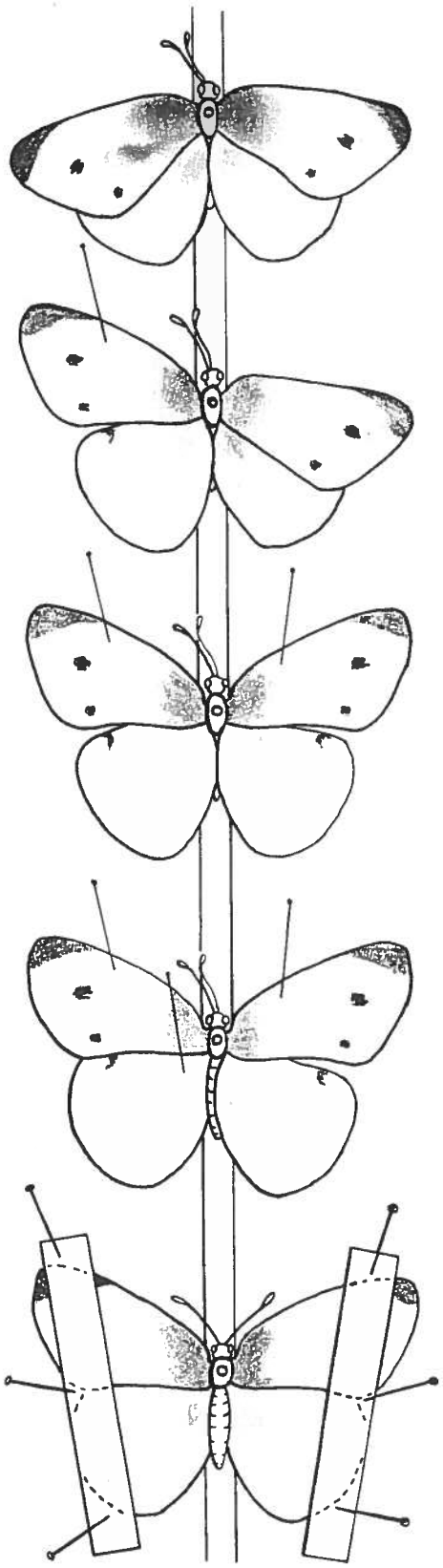








Sample insects showing correct pin placement (indicated with black dot).



Steps in the proper spreading of the wings of moths and butterflies.

Moths and butterflies are mounted as follows:

1. Pin them through the thorax as other insects. Be careful not to handle them roughly as this removes some of the delicate scales on the wings which form the colored pattern.

2. Push the pin through the center slot of a spreading board until the wings are even with the side pieces.

3. Use an insect pin to bring the front wings forward. Pull the wings forward until the rear margin of the first pair of wings is perpendicular (straight out) to the body. See the illustration in opposite column.

4. Pull the second pair of wings forward until the front margin is just beneath the first pair of wings.

If the wings do not lie flat on the board they can be anchored with a strip of paper as illustrated. The insects remain on the spreading board for a week for drying. To be of any scientific value, insects should be labeled. The label should bear:

1. The date of collection.

2. The location.

3. If you wish, the name of the collector.

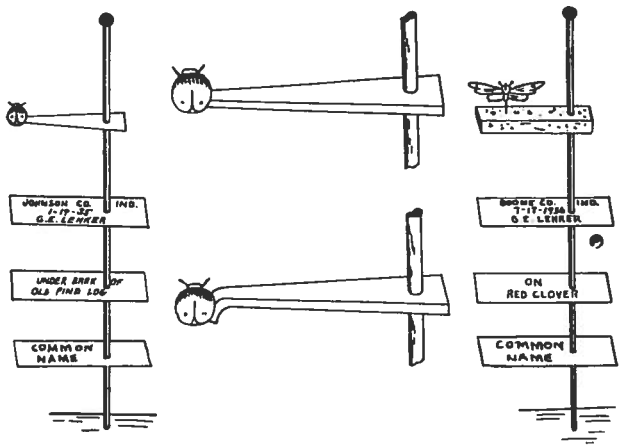
Labels of uniform size should be used. These labels should be placed at a uniform height on each pin. This can be done with the assistance of the pinning block.

Very small and fragile insects can be collected and preserved in small bottles with alcohol. These small bottles may be purchased at a biological supply house. Alcohol (rubbing alcohol) purchased at a drugstore is satisfactory for this use. The same information that is placed on a label is then written on a small piece of paper with pencil or waterproof ink, and placed inside the bottle with the insect specimen.

PRESERVE
your specimens

ADULT INSECTS

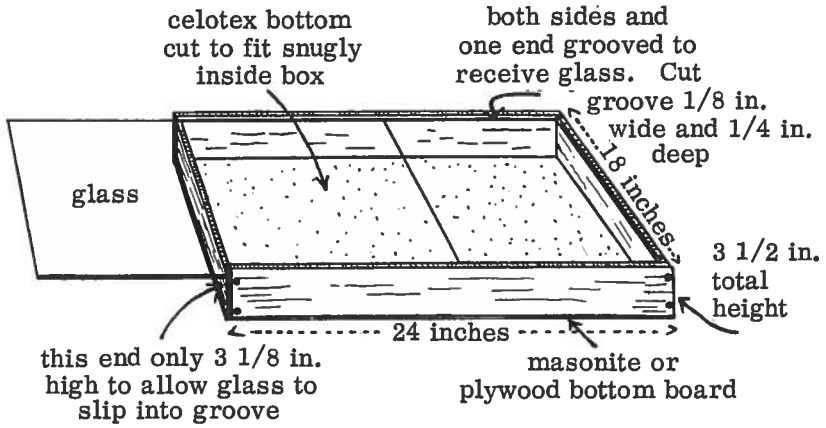
Pinned insects cannot be kept in good condition unless they are placed in boxes to protect them from dust and pests which feed on dried specimens. If you wish to use your insect collection for only studying purposes, then boxes such as cigar boxes are completely satisfactory. However, if you wish to display insects, then a more elaborate box is highly desirable. If you wish to maintain your collection for a number of years, a tight-fitting box is also necessary to prevent dust and insects from entering and feeding on preserved specimens. The box should be fitted with a corrugated paper flooring, so that insect pins may be pushed into it and removed quite easily. The drawing below will be helpful in constructing your own display box. Display boxes are also available at biological supply houses listed in the back of this circular.



Insects properly mounted and labeled (note the order of the labels).

IMMATURE FORMS

It is not possible to mount caterpillars, grubs or maggots on pins and have much of a collection. There are a number of different methods by which these specimens may be preserved. The simplest way to do this is to put the larvae, while it is still alive, into boiling water for about five minutes. This boiling water instantly kills the larvae and hardens it. This larvae can be taken from the water and placed in a small bottle and then preserved in rubbing alcohol which you can purchase in the drugstore. The same information should be placed in the bottle with the preserved larvae as you put on a label of a pinned specimen, that is; the date of collection, location of the collection and name. You should use either waterproof ink or pencil in writing the label that goes in the bottle.

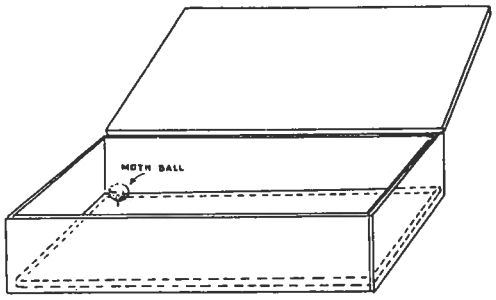


Display box for pinned insect specimens.

PROTECT
your collection

Several types of small beetles, book lice and red ants readily feed upon dried insect specimens, and may ruin an entire collection unless properly protected.

Common napthalene flakes from which moth balls are made is a good repellent. They may be used either in the flake or ball form. Flakes may be spread on the bottom of the board or placed in small containers which are in turn fastened in the box. If moth balls are used, they can conveniently be fastened to the head of a common stick pin. This may be done by holding the pin head in a flame until it is hot and pushing the hot pin into the moth ball until it is cool. When it is cool, the ball will be held firmly in place and can be stuck into the corner of the insect box. These moth balls or flakes will then prevent insects from entering your collection and destroying it.



Display box with moth ball repellent (a cigar box was used here).

IDENTIFY AND CLASSIFY
your insects

Whenever you have a large number of objects or ideas, arranging in an orderly manner greatly simplifies handling these things.

Many years ago, scientists began arranging or classifying living matter on this earth. They placed all living things into two kingdoms, the plant kingdom and the animal kingdom. Animals are defined as creatures that are free moving and eat food composed of living matter or matter that was once living. Plants, on the other hand, are not free moving. They require inorganic or nonliving matter for food such as nitrogen, carbon dioxide, oxygen, phosphorus and potassium. They usually contain chlorophyll and cellulose.

The kingdoms are then further broken down or subdivided into phylla. In the animal kingdom there are fifteen main phylla. The plant kingdom also has its own phylla; however, we will be concerned mainly with animals in this project. A Latin name is given to the phylla. These names are used world wide. Insects belong to the phylum Arthropoda.

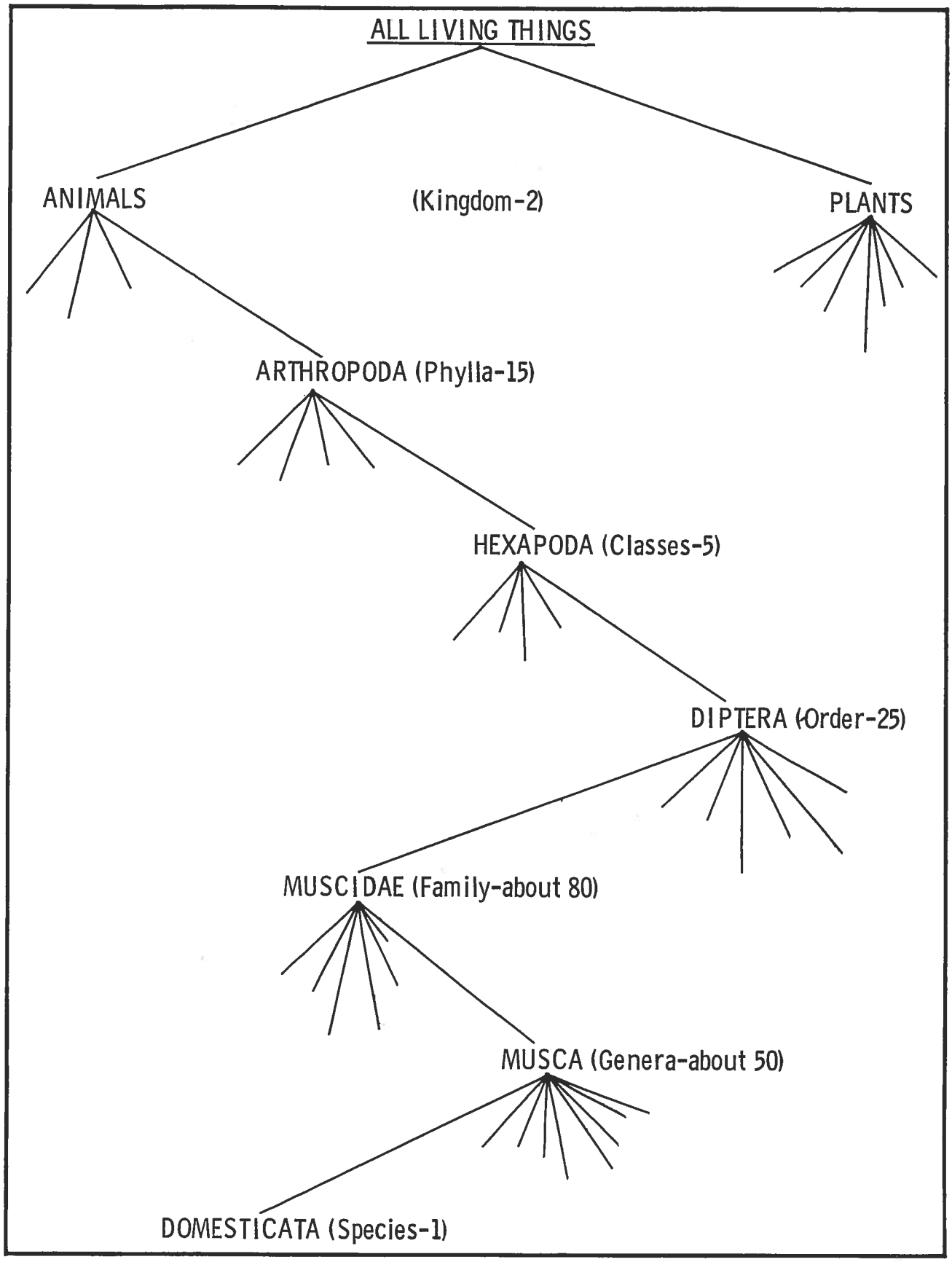
Phylla are divided into groupings called classes. Each class likewise is given a Latin name. There are five main classes in the phylum, Arthropoda. Insects belong to the class Hexapoda (sometimes called Insecta).

Classes are then divided into groups of somewhat similar insects. These groupings are called orders. As an example, flies belong to the one order Diptera, beetles to another, etc. There are some twenty-five different orders of insects.

Orders are broken down into families. In the order Diptera (flies) alone there are some eighty different families.

Families are further subdivided into alike looking groups called genera. One family of flies might contain as many as one hundred different genera. Genera are further subdivided into species. One genera of flies might contain several to one hundred different species. Scientists estimate there are some 60,000 different species of flies.

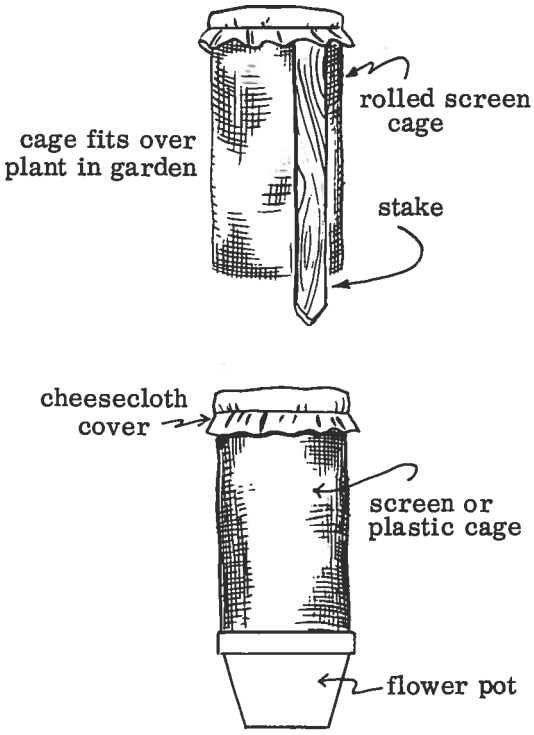
Each genus and species of a living organism has its own Latin name. This scientific name is used throughout the world and is the same whether it is used in Wisconsin, Texas, Japan or Russia.



Classification of the common housefly.

The diagram on page 20 will help you classify into orders some of the insects you have collected. Should you wish to identify some of these insects to families, specialized books must be used. These books may be obtained from a library or ordered directly from the company selling these books. They are listed in the back of this circular. Insect identification to genus and species, "a scientific name", is highly skilled art which takes years of training and is not part of the 4-H club project.

The diagram will help you see the relationship that exists between the various classes, orders, families, etc.

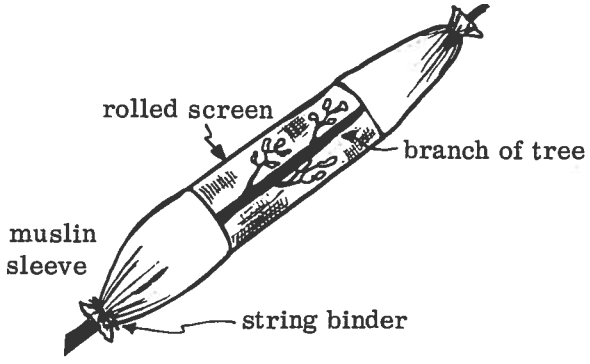


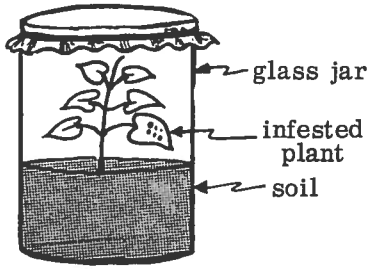
Simple cages for confining and observing live insects.

CONFINE insects for study

To study insects in detail oftentimes it is desirable to confine them to a limited area where they can be observed. Some insects can readily be confined yet others can only be caged under very exacting conditions.

The illustrations on this page are simple devices that you can make to confine and observe insects.





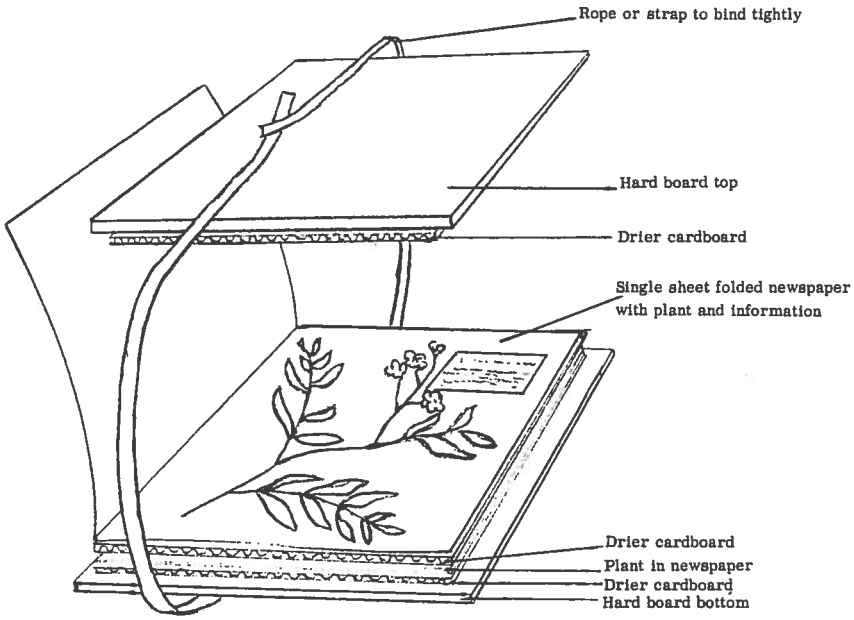
collect and mount INSECT DAMAGED PLANTS

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. Collecting, pressing, preserving and mounting of plants demand that a person handle and observe plants over a period of time. Specimens that are processed in this way will be plants that a club member will well remember. This helps the member to become familiar with the plant and how it has become injured by insects. It will also provide him with a specimen that he can use for reference and for an exhibit.

make a PLANT PRESS

The plant press is a simple device consisting of two sheets of hard board or masonite 14 x 18 inches.

The newspaper and corrugated cardboard are used as driers between hard board covers of the plant press. These driers take up the moisture from the plant. It is necessary to make the plant press before collecting is done. This is a good fall and winter activity.



A Plant Press

COLLECT plants

Collecting plants is one of the most important jobs to be done and great care must be taken. First, plants that are protected by law should not be collected. When collecting plants, you should use good judgement and collect only those plants which will indicate the type of injury you wish to show or illustrate. Be sure that permission to collect these plants has been obtained from the land owner if collecting is done on property other than your own. The equipment for collecting plants is simple:

1. Plastic bag in which to put the plants.
2. Scissors or knife for specimen.
3. Pencil and paper for taking notes.

Always try to collect the plants that are mature and 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 and state, and the date. In addition, make notes as to the kind of insects seen on the plant and those that have injured it. Additional information such as where the plant was growing such as in a woods, marsh, or roadside, etc. is also interesting. Record whether the site was sunny or shady. Record whether the soil was sandy, loam, or clay, if the plant is colored or in blossom. Record the color of the blossom, because as the plants dry, the color usually disappears. Keep this information with the specimen.

PRESS plants

As soon as you return from your field trip, put the plants in the plant press. To do this, place one piece of hard board on a table. On top of it, place a corrugated cardboard dryer. Then take a single sheet of newspaper and fold it in half. This should just fit the dryer. The paper should be unfolded and the plant placed between layers. Arrange the plant so that blossom, stem and leaves are in a position you would like to have them when the plant is dry. Your plant specimen should fit on a half sheet of newspaper. Place your plant notes in the press with the plant. Then fold the newspaper over the specimen and place another dryer on top of the newspaper. This can be followed by another plant and another dryer. The process is repeated until all the plants are in the press. The hard board cover is put on the top dryer and the press either tied or strapped together very tightly so there is pressure on your specimens. If you do not want to tie the press, place a heavy weight on top of the press.

After twenty-four hours, your plant press should be opened. You will find that the dryers are damp with moisture they have taken from the specimens. 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 that the bottom side is visible, and if the stem crosses over the leaves, the leaves should be arranged so that they are beneath the stem. The damp dryer should be laid aside to dry and new, crisp, fresh dryers inserted in the 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.

MOUNT plants

When the plants are dry they may be mounted on a suitable sheet of stiff paper. The plants can be fastened by applying glue to the under surface of the plant and then applying pressure until the glue has set. If you use tape, be sure the tape is the kind that you lick and stick. Tape on which the glue remains permanently sticky is apt to leak, thus spoiling your collection. Plants should be labeled with the name and other information you obtain when you collected the specimen, location, date and probable type of insect injury.

consider these CAREERS

About 4,500 men and women are professional entomologists in the United States. They work in such varied fields as teaching and research in colleges and universities, doing identification and basic research for government agencies such as the United States Department of Agriculture, Department of Interior, State Departments of Agriculture and State Conservation and Wildlife Departments. Still others are selling insecticides, or doing inspection and detection work for various state and federal government agencies. Some entomologists are also employed in research laboratories of companies searching for new products.

TEACHING

There are many opportunities for teaching entomology in colleges and universities. Entomology being a specialized phase of biology is often taught to students after they have studied some biology. Most entomology instructors specialize in teaching only one or two classes in entomology and spend the remaining time doing research and teaching graduate students how to do research.

Most states employ one or more extension entomologists. These individuals help adults interpret research results so they can put this information into use solving their specific problems. This is usually done at group meetings, held off campus, throughout the state. The extension entomologists also assist local county agents and local agricultural instructors by answering specific questions, and writing bulletins on the control of certain insects in their state.

HEALTH

Federal, state and local health services employ entomologists for research and control of pests such as mosquitoes, flies, ticks, etc. Many entomologists are employed by the military service throughout the world protecting our servicemen from insect nuisances and insect-borne diseases.

REGULATORY WORK

Because of the potential threat of insects to our food and fiber supply, laws regulating movement of these foods, fibers and even people are necessary. A number of entomologists are employed enforcing these laws. More recently, the laws regulating the use of insecticides were passed by state and federal governments. Entomologists are also employed as advisors to these regulatory and enforcing agencies.

RESEARCH

This work includes all phases of insect study such as the study of insect classification, habits, life histories and control. This type of work is usually done at state universities, U. S. Department of Agriculture laboratories and more recently in the research laboratories of some companies. Here scientists are looking for answers to questions yet unknown to mankind. Training in biology, chemistry, physics, mathematics and many other fields are necessary before a person becomes proficient in this field.

DETECTION AND SURVEY

Entomologists are employed by government agencies whose duties are to be on the continuous outlook for insects introduced into areas not previously infested with these insects. These same people may also inspect nurseries, beehives, some airports, ports where foreign ships dock, etc.

COMMERCIAL ENTOMOLOGY

This pertains to work in private enterprises rather than public or government agencies. Many entomologists are engaged in manufacturing, distributing, selling and application of insecticides. Some individuals are engaged in advising businessmen in the use of these insecticides. Many profitable opportunities in this field exist for aggressive and imaginative individuals.

use these REFERENCES

Handbook of the Insect World. Hercules Powder Company. Available from your County 4-H Club Agent.

How to Know the Insects. H. E. Jaques. Wm C. Brown Company, Dubuque, Iowa. This is a good handbook for identifying insects to families.

USDA Yearbook of Agriculture. 1952. May be purchased from Superintendent of Documents, Washington D. C. A good reference book on amount of damage insects cause. May be available in local libraries.

Destructive and Useful Insects. C. L. Metcalf, W. P. Flint and R. L. Metcalf. McGraw Hill Company. An excellent textbook usually used in college courses. Available in some libraries.

Collection and Preservation of Insects. USDA Publication No. 601. Available from your County 4-H Club Agent.

order insect collecting SUPPLIES

Wards Natural Science
3000 Ridge Road East
Rochester, New York

General Biological Supply House
8200 South Hoyne Avenue
Chicago, Illinois

Central Scientific Company
1700 Irving Park Road
Chicago, Illinois