Exploring

the curious world of insects

VIRGINIA COOPERATIVE EXTENSION SERVICE
Publication 444 • Reprinted October 1980
Extension Division • Virginia Polytechnic Institute and State University

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, and September 30, 1977, in cooperation with the U. S. Department of Agriculture. W. R. Van Dresser, Dean, Extension Division, Cooperative Extension Service, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061; M. C. Harding, Sr., Administrator, 1890 Extension Program, Virginia State University, Petersburg, Virginia 23803.

WELCOME

NAME

CLUB COUNTY STATE

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

By completing the Unit I Project, you have learned a great deal about insects in general. In Unit II 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 Unit I Project Book as a reference. It will help in completing the Unit II Project.

ACKNOWLEDGMENTS

This educational material has been compiled and edited for 4-H use by the National 4-H Entomology Program Development Committee, composed of representatives of the State and Federal Extension Services, the National 4-H Service Committee, and Hercules Inc. Special acknowledgment is given to cooperators in the State Cooperative Extension Services who have supplied material included in this publication.

The members of the committee at time of preparation were: Extension Entomologist, E. A. Cancienne, Louisiana; Warren T. Johnson, New York, J. O. Rowell, Virginia; Rudolph A. Scheibner, Kentucky; and Paul W. Bergman, Federal Extension Service; 4-H Staff Members, Frank J. Heitland, South Dakota, and Kemp L. Swiney, Federal Extension Service, Leon M. McNair, National 4-H Service Committee, and donor representative Wheeler O. Holmes.

LET'S FURTHER STUDY INSECTS

There are several ways to study insects. 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 those by a private collector. Keep accurate records of your entomology work which you can use for further 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 too 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 EXPERIENCES

Members may continue work in Unit II for several years. Your accomplishments should be more in-depth with each succeeding activity. Information on each activity should be recorded on the INSECT ACTIVITY REPORT.

The following suggested activities are progressively more complicated. Other activities may be designed to suit your interests. You should consult your leader in making selections.

1. Give a talk to a group on collecting, mounting and labeling insects.

2. Continue to expand your insect collection. Specimens of additional orders other than those listed under Unit I requirements should be collected.

3. Rear a beneficial or harmful insect through its life cycle and preserve all stages of development.

4. Collect and preserve immature forms of ten insects representing five or more orders, such as grubs, caterpillars and maggots.

5. Conduct an insect management program on the garden, crops, livestock, pets or in the home.

6. Make a collection of as many different insect homes as you can find in your community.

7. Collect and mount the different kinds of insects you find feeding on a plant or animal important to your state, county or community.

8. Make a collection of plant or animal material showing insect feeding signs and identify the insect responsible.

9. Make a collection of other Arthropods you find in your community. Report on how they differ from insects.

10. 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.

11. 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.

12. Apply an insecticide to control an insect infestation. Report to your club results obtained and safety precautions used in mixing and applying the insecticide.

13. Give a talk or demonstration to your club, school or community group on the importance of a good insect management program.

14. Give a talk to a community group on a national, state or local insect quarantine program, such as imported fire ants, sweet potato weevils or white fringed beatles.

15. Survey for and report to your county Extension agent on the prevalence and distribution of an insect species in your area.

16. Make an observation study and report insect activity related to a host, time of day or night, or weather and temperature conditions.

17. 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.

KEY FOR DETERMINING ORDER OF INSECTS

How To Use A Key

To use a key in determining insects you are confronted with two choices or a couplet. After deciding which description fits the specimen you are determining, go to the number indicated to the right of the couplet, ignoring all previous numbers. Just to be sure you can use a key, let's take two specimens easy to collect, i.e., a housefly and a honeybee or bumblebee.

Examine a housefly; the wings are evident so go to couplet 12 or Part II Winged Insects. Under winged insects we have two choices 12 or 12'. It has two wings and is Order Diptera or true flies.

Now take a honeybee or bumblebee. It will go to Part II and choice 12' having four wings, which directs you to 13. Under 13' it does not have scales and we are directed to 14. It has mandibles and goes to 17; the hindwings are smaller than the forewings, therefore, to 18; no cerci to 19: the wings are not hairy and the antennae are shorter than the body, so from 19' go to 20 where we have the final choice. The tarsi are not 2 or 3 segmented; the size is clearly over 3/8" in length and it is in couplet 20' Order Hymenoptera.

Some keys have a parenthesis after the first number of the couplet. The number refers to the couplet from which you came. We have followed this style in order to familiarize you with this style. The parenthesis has an advantage in that it enables you to work backwards and check yourself if you think you have made a mistake.

1	Wingless insects	2
1'	Winged insects	12

I Wingless Insects

2 (1)	Mouthparts sucking (a sucking tube usually evident but in the parasitic sucking life, Anoplura, stylets sometimes withdrawn into head)	3
2'	Mouthparts chewing (mandibles sometimes retracted and concealed)	6
3 (2)	Ectoparasites live on birds or mammals; body flattened dorsoventrally (from top to bottom) or laterally (from side to side)	4
3'	Free living; body not usually flattened	5
4 (3)	Body flattened laterally; jumping insects	SIPHONAPTERA
4'	Body flattened dorsoventrally; tarsi with one large claw	ANOPLURA
5 (3')	Body long and narrow; mouthparts cone-shaped and arising from front of head	THYSANOPTERA
5'	Body oval; mouthparts a long sucking tube and arising from hind part of head	HOMOPTERA
6 (2')	Ectoparasites on birds or mammals; antennae with five or fewer segments; no springing appendage near end of abdomen	MALLOPHAGA
6'	Not ectoparasites; free living; antennae 6 or more segments (except some springtails, Collembola, which has 4 or 5 segments and springing appendage near end of abdomen)	7
7 (6')	Abdomen with two or three thread-like appendages ("tails")	THYSANURA
7'	Abdomen lacking tread-like appendages	8
8	Abdomen constricted at base; antennae usually elbowed	HYMENOPTERA
8'	Abdomen not constricted at base; antennae not elbowed	9

9 (8')	Abdomen and antennae with 6 or fewer segments; usually with a forked spring appendage near end of abdomen	COLLEMBOLA	
9'	Abdomen and antennae with more than 6 segments; no ventral springing organ		10
10 (9')	Tarsi 2 or 3 segmented with compound eyes: no cerci	CORRODENTIA	
10'	Tarsi 4 or 5 segmented; with cerci		11
11 (10')	Tarsi 4 segmented; small whitish soft-bodied colonial insects	ISOPTERA	
11'	Tarsi 5 segmented; not as above (roaches and walking sticks)	ORTHOPTERA	

II Winged Insects

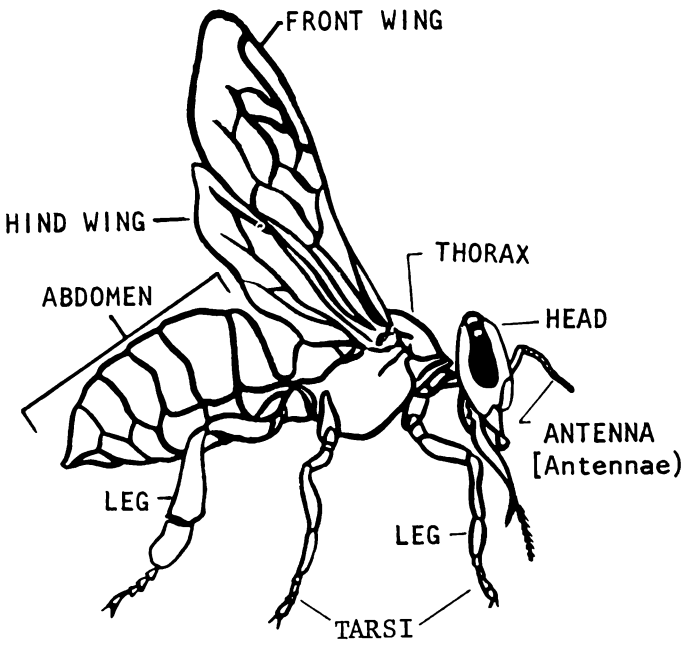
With the exception of the Odonata, some wingless forms occur in all the other orders of insects. This key is designed for determining members of those orders which are normally winged.

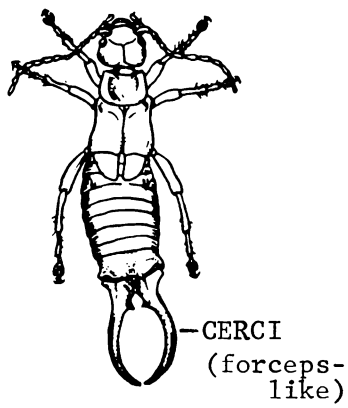
This key is not designed for the exceptional wingless member of orders normally possessing wings.

12 (1')	With two wings	DIPTERA	
12'	With four wings		13
13 (12')	Wings covered with scales	LEPIDOPTERA	
13'	Wings not covered with scales		14
14 (13')	With distinct sucking or sucking-rasping tubular mouthparts, without mandibles		15
14'	With chewing or vestigial mouthparts (bees, Hymenoptera, have elongated tongue-like structure but with mandibles evident)		17
15 (14)	Wings long and narrow and fringed with long hair	THYSANOPTERA	
15'	Wings not fringed with long hair		16
16 (15')	Beak arising from front part of head; front wings leathery at base and membranous at tip	HEMIPTERA	
16'	Beak arising from hind part of head; front wings membranous throughout	HOMOPTERA	
17 (14')	Hindwings usually shorter and much smaller in area than front wings		18
17'	Hindwings are as large as or larger than forewings		21
18 (17)	With long cerci; antennae short, bristle-like and inconspicuous	EPHEMEROPTERA	
18'	Without cerci; antennae longer than head and conspicuous		19
19 (18')	Wings distinctly hairy; venation in front and hindwings similar; antennae as long or longer than body	TRICHOPTERA	
19'	Wings not hairy; fewer veins and cells in hindwings than in forewings; antennae shorter than body		20
20 (19')	Tarsi 2 or 3 segmented; small insects less than 3/8 inch in length	CORRODENTIA	
20'	Tarsi 4 or 5 segmented (usually 5 segmented); large insects (except for small parasites and winged ants); the specimens you collect will usually exceed $\frac{1}{4}$ inch in length	HYMENOPTERA	

21 (17')	Front wings horny, leathery or thicker at base		22
21'	Wings membranous throughout		24
22 (21)	Abdomen with forceps-like cerci	DERMAPTERA	
22'	Abdomen without forceps-like cerci		23
23 (22')	Front wings without veins and usually meeting in a straight line down back; antennae with less than 12 segments; abdomen without cerci	COLEOPTERA	
23'	Front wings with veins and held roof-like over back or overlapping; antennae with more than 12 segments; abdomen with cerci	ORTHOPTERA	
24 (21')	Head prolonged ventrally into a beak	MECOPTERA	
24'	Head not prolonged into a beak-like structure		25
25 (24')	Antennae short, bristle-like and inconspicuous	ODONATA	
25'	Antennae long and conspicuous		26
26 (25')	Cerci present; tarsi 3 segmented	PLECOPTERA	
26'	Cerci absent; tarsi 5 segmented	NEUROPTERA	

PARTS OF AN INSECT





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 3 1/2 x 24 inches.

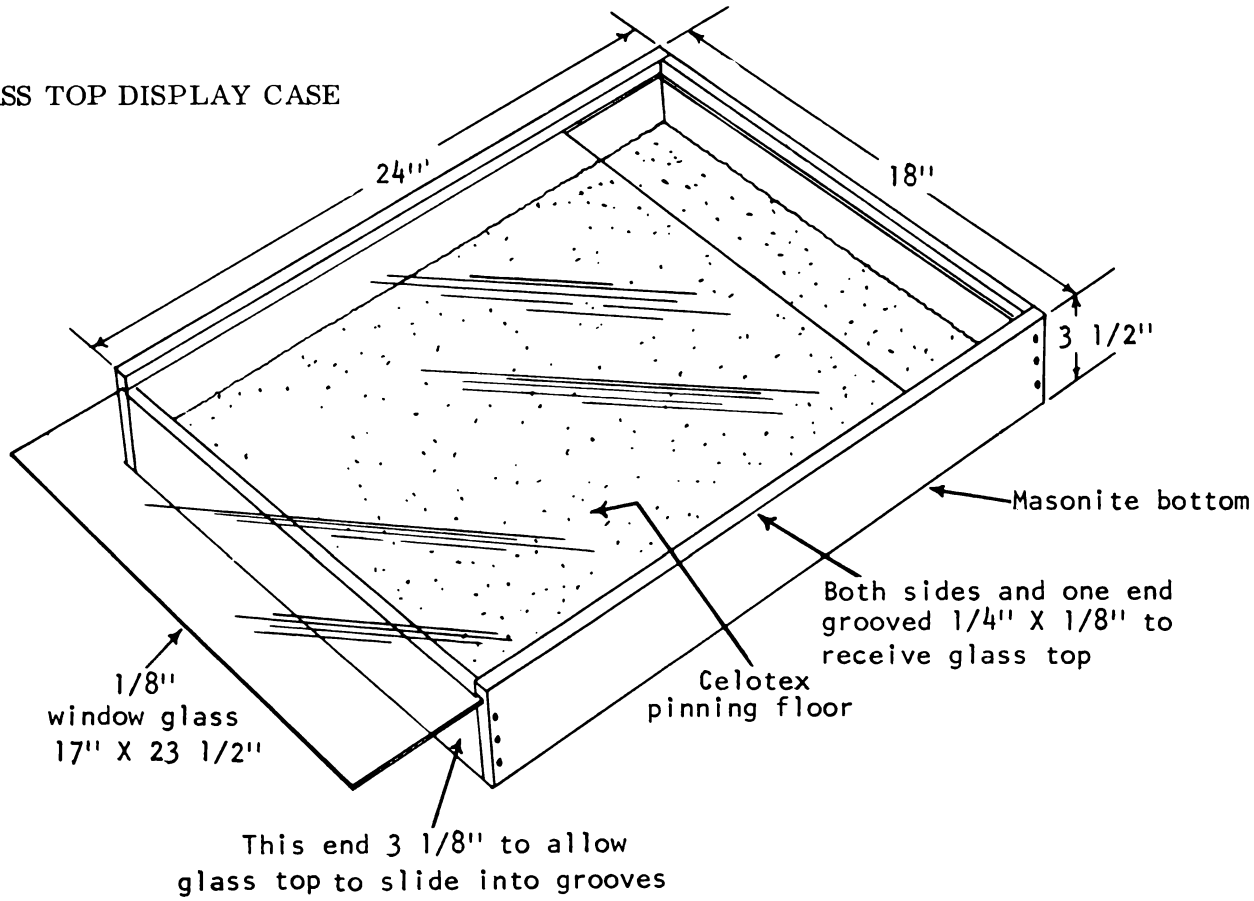
3. One end piece of pine - 3/4 x 3 1/2 x 16 1/2 inches.

4. One end piece of pine - 3/4 x 3 1/8 x 16 1/2 inches.

5. One piece of Celotex or similar soft fiberboard for pinning floor - 16 1/2 x 22 1/2 inches.

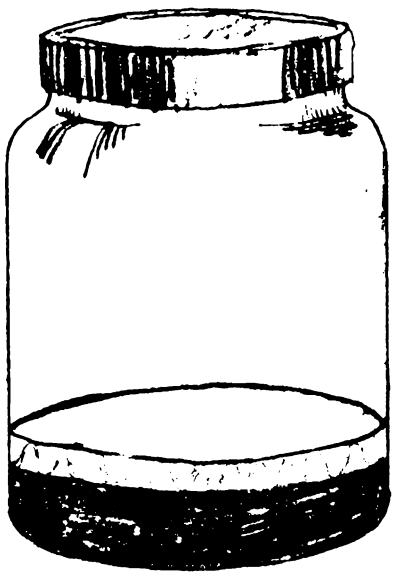
6. One piece of window glass 1/8 inch thick - 17 x 23 1/2 inches.

GLASS TOP DISPLAY CASE



RELAXING DRY SPECIMENS

Sometimes insects get too dry and become hard and brittle for mounting. Butterflies and moths are good examples of this. 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:

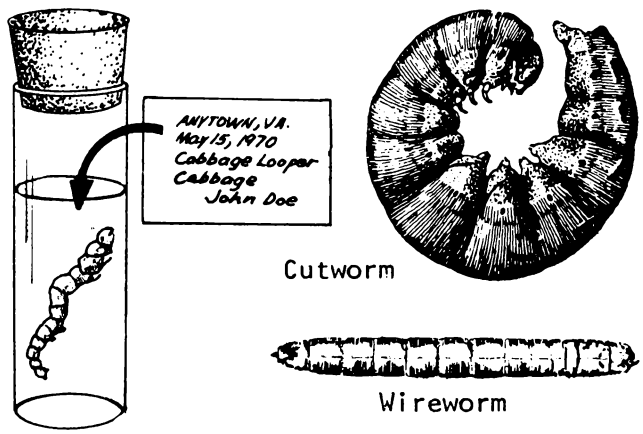
1. Pour one inch of sand in the bottom of the jar or can and moisten with water.
2. Add a few pinches of naphthalene flakes to prevent mold.
3. Cut a piece of cardboard and fit tightly over sand.

PRESERVING IMMATURE INSECTS AND OTHER ARTHROPODS

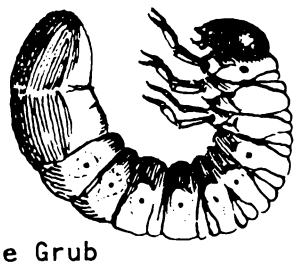
Small vials or bottles and 70% alcohol can usually be obtained at your local drugstore. Vials or bottles (about $\frac{1}{2}$" x $2\frac{1}{2}$") with cork or screw cap may be used.

How to use:

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




Leaf Aphid


White Grub

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 may also be preserved in this manner.

REARING INSECTS

An easy way to learn about insects is to study their life cycle. This can be done 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 as many caterpillars pupate in soil. Place a branch in the jar for the adult to climb on when it emerges.

Potato beetles can be reared on a potted potato 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 and a little sugar in the bottom of the jar. Keep the bran 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 which are generally on the abdomens of the adult roaches until they are almost ready to hatch. Rearing roaches will require several weeks.

Plant lice (aphids) are easy to rear on the 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 own imagination. Some examples of insects, suitable for rearing, together with their food or host plants are as follows:

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:

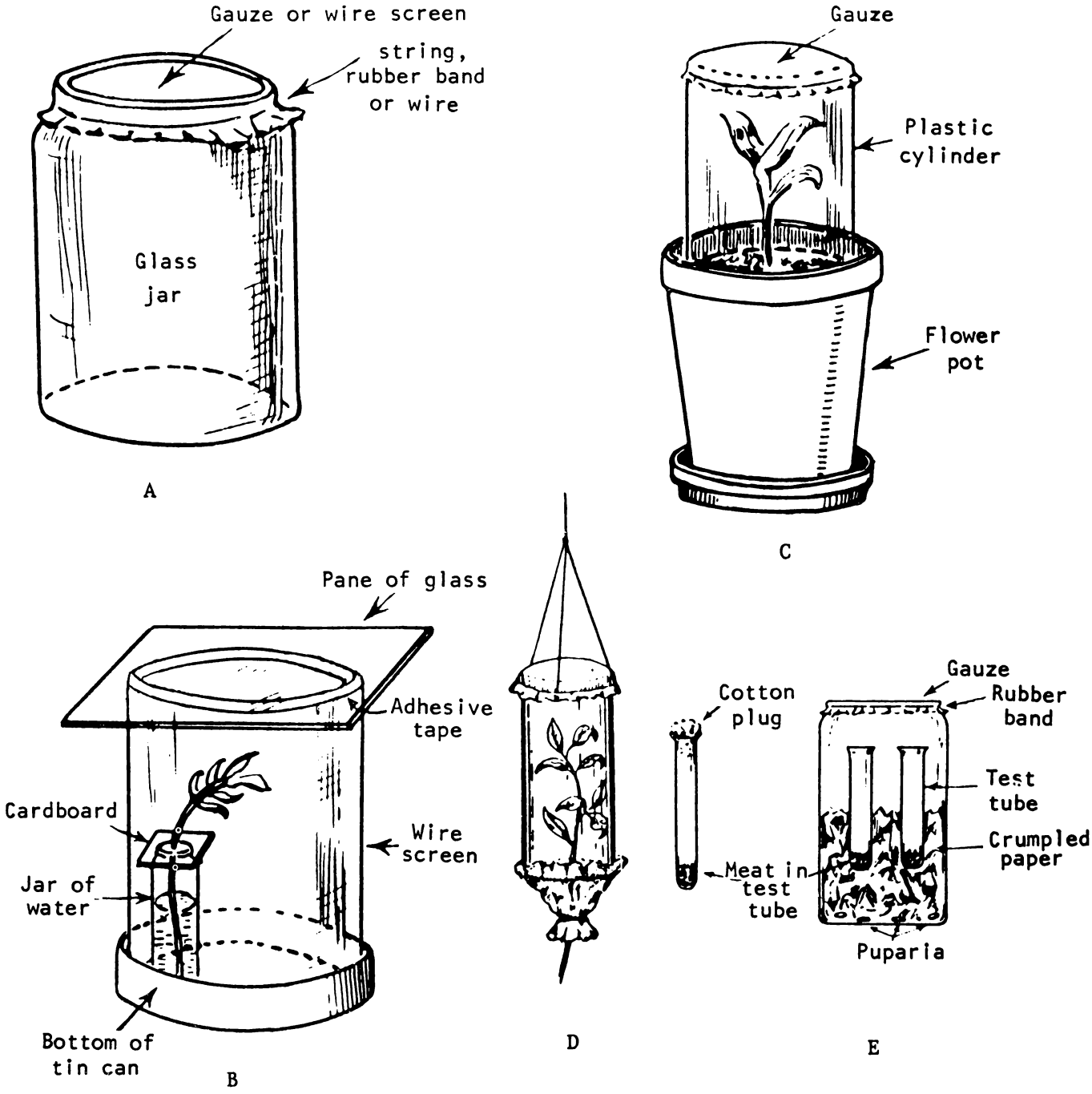
1. Select a rearing cage appropriate for the insect.

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 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 is one with 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.

TYPES OF REARING CAGES



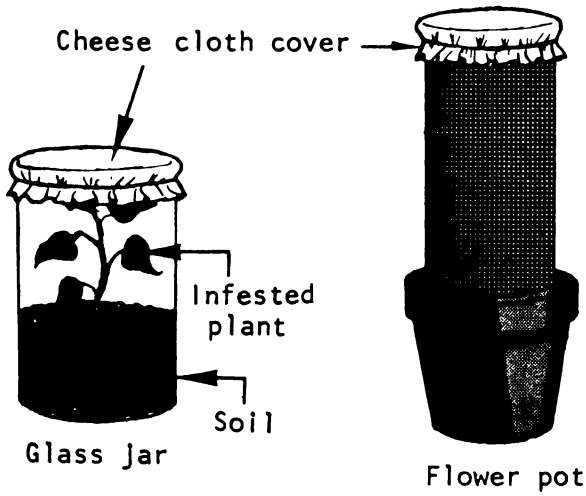
A. The simplest type cage; food and/or water may be placed in bottom of jar.

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.

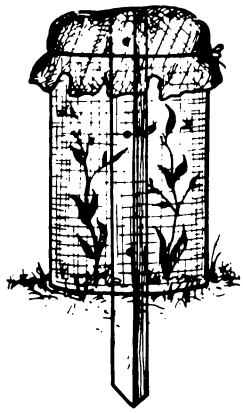
E. A cage for rearing blowflies.

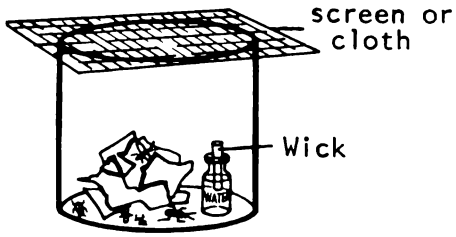


Glass jar

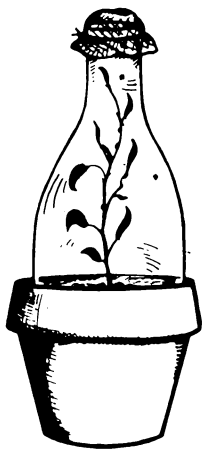
Flower pot

Rolled screen cages

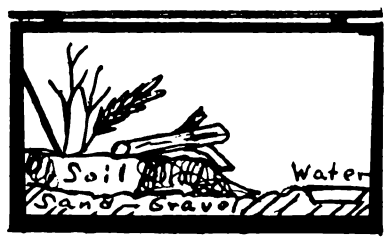




Battery Jar



Lamp shade



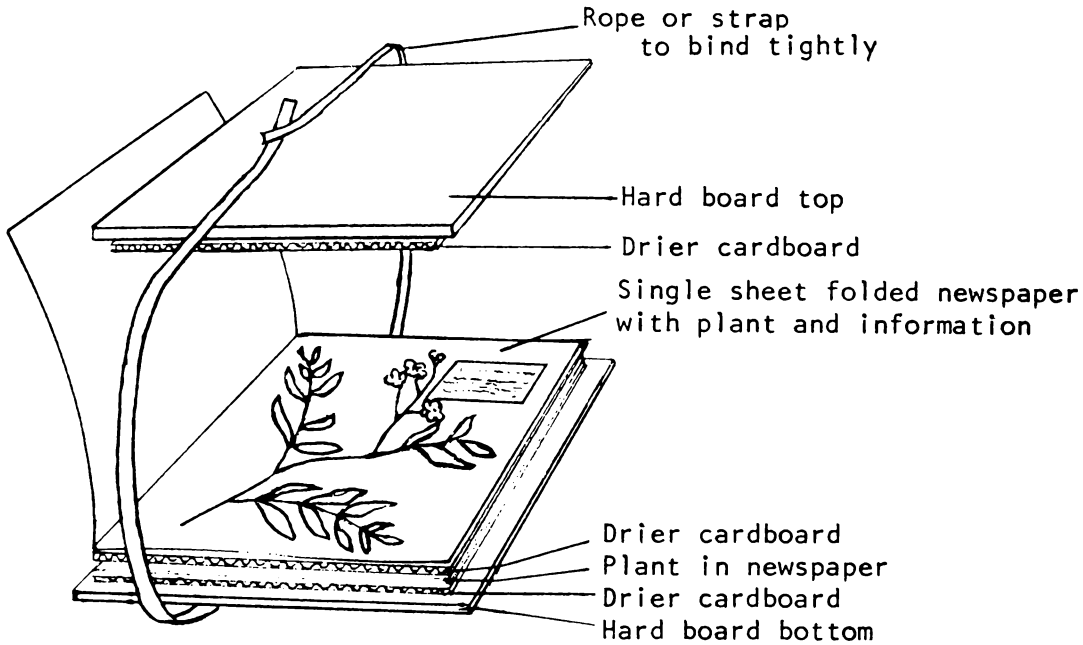
Terrarium

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.

Plant Press

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



A plant press

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.

Collect 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. The equipment for collecting plants is simple:

1. Plastic bag in which to put the plants.
2. Scissors or knife for cutting specimen.
3. 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 nearest town, the county and state and the date. Make notes as to the kind of insects seen on the plant and those that have injured it. Additional information on where the plant was growing, such as in a woods, marsh or roadside, is also interesting. Record whether the site was sunny or shady; whether the soil was sandy, loam or clay; if the plant is colored or in blossom, and 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 returning from a 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 drier. Then take a single sheet of newspaper and fold it in half. This should just fit the drier. 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. Place plant notes in the press with the plant. Fold the newspaper over the specimen and place another drier on top of the newspaper. This can be followed by another plant and another drier. The process is repeated until all plants are in the press. 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 should 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 should be 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.

Mount Plants

When the plants are dry they may be mounted on stiff paper. The 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 lick 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.

UNDERSTANDING THE PRESENCE OF INSECTS

The following three sections: (I) The Value of Insects to Man, (II) Harmful Insects, and (III) Managing Insects to Fit Man's Needs, will help in understanding why insects are of concern to man.

I. The Value of Insects to Man.

So much of the literature about insects deals with their destructiveness that we sometimes forget the usefulness of insects to man. These creatures should be studied carefully so we can distinguish insect friends from insect enemies. The following are some ways insects help man:

A. Insects produce and collect useful products or articles for commerce, such as silk, beeswax, honey, shellac, tannic acid, inks and dyes.

B. Insects aid in the production of fruits, seeds, vegetables and flowers by pollinating the blossoms.

C. Insects serve as food for many animals and birds. In many parts of the world they are food for man.

D. Many insects destroy other injurious insects.

E. Insects destroy some weeds harmful to crops.

F. Insects improve the physical condition of soil and aid fertility.

G. Insects are scavengers and eat bodies of dead animals and plants.

H. Insects are used in scientific investigations.

I. Insects and insect products have certain uses in medicine.

J. Insects have an aesthetic and entertainment value.

II. Harmful Insects.

The struggle between man and insects began long before the dawn of civilization, has continued to the present time and will, no doubt, continue as long as man exists. This is the struggle for existence of all species of animals, concentrating on three basic needs to sustain life which are protection, food and reproduction.

A. Insects destroy or damage growing crops and other valuable plants.

B. Insects annoy and injure man and other animals, both tame and wild by:
   1. Causing annoyance and misery by flying about, crawling over the skin, chewing, piercing and laying eggs.
   2. Applying or injecting venoms.
   3. Making their homes on or in the body.
   4. Spreading disease.

C. Insects destroy or damage stored products including food, clothing, drugs, animal and plant collections, paper, books, furniture, buildings, wood products and other items.

III. Managing Insects to Fit Man's Needs

Because insects destroy or damage items man wants and likes, man tries to reduce the number of times this will happen. Man may try different management methods on a few insects or a large population of insects. The following outline gives examples of different practices:

A. Applied Control - Methods under the control of man.
   1. Chemical Control - Substances that kill insects by their chemical action. These include stomach poisons, contact poisons, systemic insecticides and fumigants.
   2. Physical and Mechanical Control - Special operations that kill insects by physical or mechanical action.
      a. Physical measures include changing water (drainage), humidity (dehydration); temperature, or by electric shocks, light or sound waves.
      b. Mechanical measures include the operation of machinery or manual operations, such as hand destruction, screening, nets, traps and crushing.
   3. Cultural Control - Regular operations performed to destroy insects or prevent damage. This includes crop rotation, tilling the soil, destroying crop residues, varying time of planting or harvesting and use of resistant varieties.
   4. Biological Control - The destruction or suppression of undesirable insects by the artificial increase of their natural enemies. This includes parasitic or predacious insects, predatory animals, nematodes, insect pathogens (disease) and biological control of weeds.
   5. Legal Control - The control of insects by controlling human activities. This is practiced through quarantine and inspection laws, compulsory clean-up measures and insecticide laws.

B. Natural Control - Measures which destroy or check insects not dependent upon man for success or influence.
   1. Climatic factors, such as rainfall, sunshine, cold, heat and wind movement.
   2. Topographic features, such as large bodies of water, mountain ranges, streams and soil types.
   3. Presence of predators and parasites including birds, fish, reptiles and mammals.
   4. Insect pathogens (disease) naturally present which include nematodes, protozoa, fungi, bacteria and viruses.

OTHER SUGGESTED ACTIVITIES

Record all information on any activity completed and write a report of work for 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. This 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, phoebes and catbirds, 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 sight of the birds. What kind of food did the parents feed their young for each species of birds?

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, purple martins and chimney swifts. 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 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 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 insect feeding on aphids eat other insects such as moths, crickets, 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 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:

... looks like a twig. (What happens when larva is disturbed? Left alone?)
... looks like bark of a tree.
... is green like leaves of plants.

...has spots that look like eyes of larger animals.
...is the color of the flower you found it on.

How do these traits aid these insects?

10. 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 job?

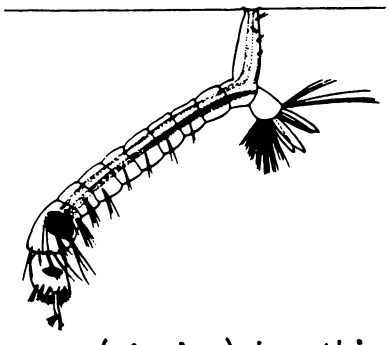
Drop an ant from another colony into the group. Is it accepted? Drop some other insects into the group. What happens? Try particles of food and observe results.

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.

In the first jar place a small minnow. In the second jar, place about two drops of an insecticide[1] 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 larva (wiggler) breathing through air tube at water surface (greatly enlarged).

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

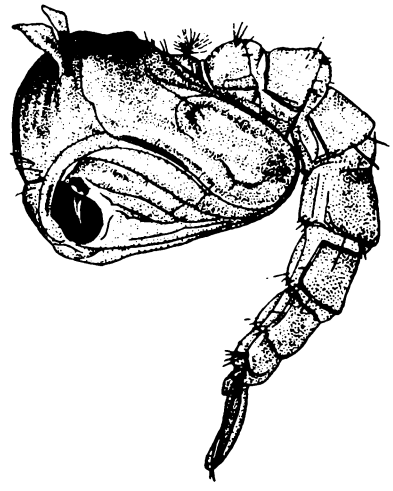
Locate a pond or pool of water that contains a large number of mosquito larvae. With a dipper or cup, capture 25 live larvae and place them in a pan of water. Fill the rest of the pan to a depth of one or two inches with water from the same pond or pool. Place a tight fitting screen over the pan and put in a cool area, such as a basement or shaded corner of a garage. In another pan place 25 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 you might observe taking place. 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 feed, and on which they 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?



Pupa of a mosquito (greatly enlarged).

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

[1] Do this experiment in a well-ventilated area under adult supervision.

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 are sufficient.

Cover each jar with a screen cover or cap with a number of small holes. Place one jar in a warm but 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 may 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 the food should be a little moist. Mold often becomes a problem in the culture and can kill the 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 also 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.

Questions to be answered for this experiment. 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; then count them.

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

6. Does the quantity of food affect rate of growth 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 product 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?

2. How much damage is done by a particular insect to a crop important to your county? Insects do a tremendous amount of damage to food and fiber crops. In your library why don't you look up how many dollars worth of damage this amounts to in the United States? In Virginia? In your county? What insects caused this damage?

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

Universities and United States Department of Agriculture help producers of food by sug-

gesting 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.

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 he has 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 (clover or alfalfa)?

Collect insects in a hayfield and a flower garden on four different dates, such as in May, June, July and August. Select 10 different insects collected from each location, record the time you collected them and mount them on insect pins. Keep them in your insect collecting box. Identify them according to 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 the most insects in the hayfields? What month did you find the most insects in the flower garden? 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 May, June, July and August, collect as many insects as you can in and around lakes, rivers or ponds and compare them with what you can collect in a clover or an alfalfa field. Mount at least 10 different kinds of insects from each area. Keep them in your insect collection box. Identify them according to order and label correctly.

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 of the insects in the rivers, lakes or streams; in the hayfields?

3. Can insects be attracted with baits?

Obtain three quart jars. Lay them on their side in a place where direct sunlight will not reach them and small animals or dogs cannot disturb them. In one jar, place a small amount of raw hamburger. In another, place some ripe fruit, such as cantaloupe or watermelon rinds, apples or peaches. In 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 in bait traps, 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. Identify according to proper order and label them.

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, May, June, July and August.

Identify these insects according to order and label them.

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 each of the different colored light bulbs? Did you find the same kinds of insects around these different colored light bulbs during the different months?

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

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

8. 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.

9. 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 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 displays.

11. 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, 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.

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 direct 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?

Control Activities

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

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 type 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 his 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:
   (1) objectionable residues from getting on food or food crops?
   (2) poisoning of birds, animals, fish and other beneficial forms of life?
   (3) 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 reoccurrence 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 nonchemical 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:
   (1) personnel while performing their duties?
   (2) local citizens?
   (3) birds, animals, fish and other beneficial forms of life?

k. What precautions were taken to prevent pollution of air, soil and water?

l. What follow-up activities (maintenance and surveillance) were performed to prevent a reoccurrence 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.

DEMONSTRATIONS

Demonstrations give you the opportunity to show how to work with 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.

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 subject matter available beforehand, so you will be prepared to answer questions after your demonstration. Visit with your local leader or county Extension agent for suggested topics and sources of information.

CAREERS IN ENTOMOLOGY

Interesting scientific entomology work is available for both young men and women. Entomology is a part of biology, the two overlap in many areas, such as ecology, genetics, physiology and microbiology. Examples of other fields associated with entomology are plant pathology, horticulture, chemistry, medicine, economics, business management and physics.

Entomologists with Bachelor of Science degrees hold positions with federal and state agencies, chemical companies, federal and state plant inspection agencies, food processors, mosquito abatement agencies, pest control companies and as science teachers.

Entomologists with Master of Science or Ph. D. degrees have professional careers in college teaching, Cooperative Extension Service, sales, administration and research in private industry, government and universities. Positions are also available with federal and state agencies, military services, conservation agencies and museums. Many enter private practice as pest control operators or consulting entomologists. Opportunities in professional entomology are rapidly increasing. There is a steady demand for more and better trained entomologists.

RECORDS

Written records are the basis of consideration for awards at state and national events. Very seldom are member's exhibits or collections judged for awards. When you are ready to submit your record for consideration for state or national recognition, you should contact your local leader or Extension agent for forms and requirements. It would be wise to study a copy of the National 4-H Report Form so you can be familiar with contents of an overall record. You should save all project records of previous 4-H work, newspaper clippings and photographs that pertain to the projects for your overall record book. Your leader can assist you in making selections to be included. This book should be a record of your achievement rather than a memory book.

Your record should include a story about your 4-H experiences and achievements. This story should stress the project in which you are entered for consideration. It should tell things you learned and indicate changes you would make if you were to start again. This story should give a capsule view of you as a 4-H member, particularly a 4-H Entomology member.

INSECT ACTIVITY REPORT

INSECT ACTIVITY REPORT

Kind of Activity _____ Activity Number _____

Observation, Experimental, Library, etc.

Use one sheet for each activity completed.

A. Statement of problem under study _____

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

C. What were your observations? _____

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

INSECT ACTIVITY REPORT

INSECT ACTIVITY REPORT

Kind of Activity _____ Activity Number _____

Observation, Experimental, Library, etc.

Use one sheet for each activity completed.

A. Statement of problem under study _____

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

C. What were your observations? _____

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

INSECT ACTIVITY REPORT

INSECT ACTIVITY REPORT

Kind of Activity _____ Activity Number _____

Observation, Experimental, Library, etc.

Use one sheet for each activity completed.

A. Statement of problem under study _____

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

C. What were your observations? _____

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

INSECT ACTIVITY REPORT

INSECT ACTIVITY REPORT

Kind of Activity _____ Activity Number _____

Observation, Experimental, Library, etc.

Use one sheet for each activity completed.

A. Statement of problem under study _____

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

C. What were your observations? _____

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

INSECT ACTIVITY REPORT

INSECT ACTIVITY REPORT

Kind of Activity _____ Activity Number _____

Observation, Experimental, Library, etc.

Use one sheet for each activity completed.

A. Statement of problem under study _____

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

C. What were your observations? _____

What are your conclusions—what did you discover?

INSECT STUDY RECORD

_____ Age _____ County _____

Years in Club Work _____ Years in This Project _____

DEMONSTRATIONS OR ILLUSTRATED TALKS I HAVE GIVEN

Topic	Where

EXHIBIT RECORD

What was Exhibited	Where Exhibited	Placings		
		Blue	Red	White

INSECT STUDY RECORD

_____ Age _____ County _____

Years in Club Work _____ Years in This Project _____

DEMONSTRATIONS OR ILLUSTRATED TALKS I HAVE GIVEN

Topic	Where

EXHIBIT RECORD

What was Exhibited	Where Exhibited	Placings		
		Blue	Red	White

Record of Insects Collected

	COMMON NAME (Tiger Beetle, Stink Bug, etc.)	ORDER	COLLECTED FROM (plant or animal host or other place)	LOCALITY (nearest town)	COLLECTION DATE	IMPORTANCE TO MAN			NUMBER OF WINGS			KIND OF MOUTH PARTS		
						Beneficial	Harmful	Doubtful	0	2	4	Chewing	Sucking	Lapping
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														

(Use 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)	COLLECTION DATE	IMPORTANCE TO MAN			NUMBER OF WINGS			KIND OF MOUTH PARTS		
						Beneficial	Harmful	Doubtful	0	2	4	Chewing	Sucking	Lapping
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														

(Use 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)	COLLECTION DATE	IMPORTANCE TO MAN			NUMBER OF WINGS			KIND OF MOUTH PARTS		
						Beneficial	Harmful	Doubtful	0	2	4	Chewing	Sucking	Lapping
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														

(Use 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)	COLLECTION DATE	IMPORTANCE TO MAN			NUMBER OF WINGS			KIND OF MOUTH PARTS		
						Beneficial	Harmful	Doubtful	0	2	4	Chewing	Sucking	Lapping
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														

(Use 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)	COLLECTION DATE	IMPORTANCE TO MAN			NUMBER OF WINGS			KIND OF MOUTH PARTS		
						Beneficial	Harmful	Doubtful	0	2	4	Chewing	Sucking	Lapping
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														

(Use 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)	COLLECTION DATE	IMPORTANCE TO MAN			NUMBER OF WINGS			KIND OF MOUTH PARTS		
						Beneficial	Harmful	Doubtful	0	2	4	Chewing	Sucking	Lapping
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														

(Use additional sheets as needed.)

LABELS

Cut out and use these labels.

Example →	Common Name • Flea Beetle		Example →	Alexandria, La. Jan. 15, 1970 John Rogers	
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			

Insect Killing Jar

POISON POISON

DANGER

MAY BE FATAL IF INHALED OR SWALLOWED

LABELS

Cut out and use these labels.

Example →	Common Name • Flea Beetle		Example →	Alexandria, La. Jan. 15, 1970 John Rogers	
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			
Common Name •	Common Name •	Common Name •			

Insect Killing Jar

POISON

DANGER

MAY BE FATAL IF INHALED OR SWALLOWED

LABELS

Cut out and use these labels.

Example →	WHERE FOUND • ON POTATO

WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •

CORRODENTIA Book & Bark Lice	MALLOPHAGA Biting Lice
THYSANOPTERA Thrips	ANOPLURA Sucking Lice
NEUROPTERA Lacewings	HEMIPTERA True Bugs
MECOPTERA Scorpionflies	HOMOPTERA Aphids, Leafhoppers
TRICHOPTERA Caddisflies	LEPIDOPTERA Moths, Butterflies
THYSANURA Silverfish	ODONATA Dragonflies Damselflies
COLLEMBOLA Springtails	ORTHOPTERA Grasshoppers, Roaches, Crickets
EPHEMERIDA Mayflies	COLEOPTERA Beetles
ISOPTERA Termites	DIPTERA Flies
PLECOPTERA Stoneflies	STREPSIPTERA Twisted-wing parasites

LABELS

Cut out and use these labels.

Example →	WHERE FOUND • ON POTATO

WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •
WHERE FOUND •	WHERE FOUND •	WHERE FOUND •

• CORRODENTIA • Book & Bark Lice	• MALLOPHAGA • Biting Lice
• THYSANOPTERA • Thrips	• ANOPLURA • Sucking Lice
• NEUROPTERA • Lacewings	• HEMIPTERA • True Bugs
• MECOPTERA • Scorpionflies	• HOMOPTERA • Aphids, Leafhoppers
• TRICHOPTERA • Caddisflies	• LEPIDOPTERA • Moths, Butterflies
• THYSANURA • Silverfish	• ODONATA • Dragonflies Damselflies
• COLLEMBOLA • Springtails	• ORTHOPTERA • Grasshoppers, Roaches, Crickets
• EPHEMERIDA • Mayflies	• COLEOPTERA • Beetles
• ISOPTERA • Termites	• DIPTERA • Flies
• PLECOPTERA • Stoneflies	• STREPSIPTERA • Twisted-wing parasites