

4-H ENTOMOLOGY 1

Collection and Study



4-H ENTOMOLOGY 1

INTRODUCTION

The study of insects is a science called *entomology*. Insects are small animals and are abundant everywhere. Over 1,000,000 different insects have been described and named in the world. In North Carolina we have over 15,000 different kinds or species of insects that have been collected.

Insects, being small animals, have served science well in the fields of genetics and aerospace biology.

Some insects, such as the honeybee, have contributed much to our world economy through the pollination of wild and cultivated crops and the production of honey and bees wax. The silk worm created a whole industry for many years because of its production of silk. There are also thousands of insects which may prove beneficial under certain conditions through their attacks as parasites and predators on other insects.

We are aware of the damage of insects, which is in the billions of dollars, to our homes, food, clothing and health. Many new approaches to the control of nuisance and harmful insects are under investigation, but the most economical and efficient control is still through the proper use of chemicals, or a combination of mechanical, cultural, biological and/or chemical methods.

WHAT IS AN INSECT?

Insects are animals belonging in the Animal Kingdom, which consists of about 15 large groups called *Phyla*. Each *Phylum* is further divided into *Classes*, *Orders*, *Families*, *Genera*, and *species*. The *species* is a group of insects which interbreed under natural conditions.

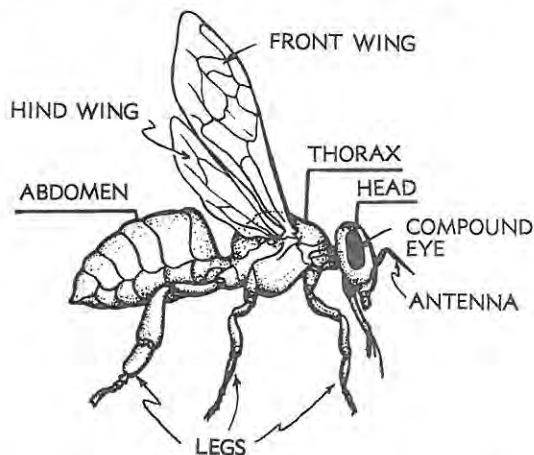
Insects belong in the *Phylum ARTHROPODA*. These animals have jointed feet, thus the name. Included are many Crustaceans, centipedes, millipedes, spiders, etc. All have a hard outside covering called an exoskeleton.

The insects are in a large group referred to as *the Class Insecta*. The main characteristics are as follows:

1. Three distinct body regions—head, thorax, and abdomen.
2. Three pairs of legs.
3. Two pairs of wings (or traces of them).

Each Class is divided into smaller groups called *Orders*. There are three factors on which the classification of an *Order* is based.

1. Type of mouthparts.
2. Kind of metamorphosis.
3. Wing structure (especially the fore wing).

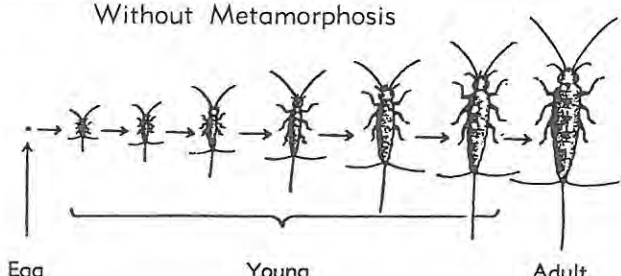
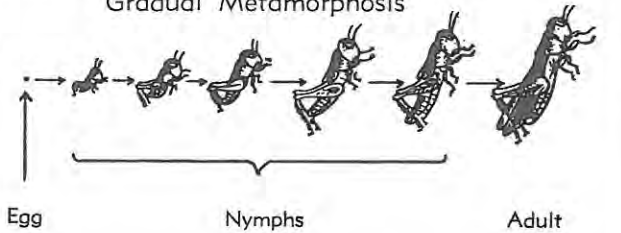
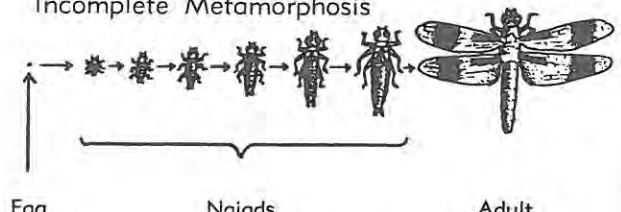
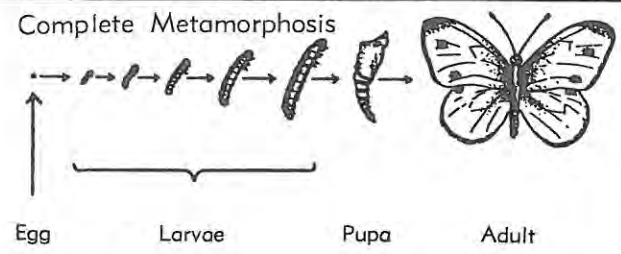


4-H members should be able to identify most insects to Order. This is all that is required in Entomology I. To continue the project and identify insects to Families, Genera, and species, specialized references are needed.

HOW INSECTS LIVE AND GROW

Where an insect lives, what it eats, what its habits are, and how it reproduces are all questions of insect biology. Most of them can be answered by a study of an insect's life cycle.

The life cycle of an insect is from the egg stage to the reproducing adult. How and what it does during this period is its biology. Metamorphosis is the name given to the change in shape of an insect as it grows. Insects are divided into four groups, depending upon their method of metamorphosis. Some teachers consider only two types of metamorphosis; namely, complete as shown and all the rest as incomplete.

METAMORPHOSIS OF VARIOUS INSECTS		
<u>Examples</u> Silverfish Springtail	<u>Orders</u> Thysanura Collembola	Without Metamorphosis 
<u>Examples</u> Grasshoppers Termites Booklice Thrips True Bugs Aphids Earwigs Chewing Lice Sucking Lice	<u>Orders</u> Orthoptera Isoptera Psocoptera Thysanoptera Hemiptera Homoptera Dermaptera Mallophaga Anoplura	Gradual Metamorphosis 
<u>Examples</u> Mayflies Dragonflies Stoneflies	<u>Orders</u> Ephemeroptera Odonata Plecoptera	Incomplete Metamorphosis 
<u>Examples</u> Lacewings Beetles Scorpionflies Caddisflies Moths, Butterflies Flies Fleas Wasps, Bees, Ants	<u>Orders</u> Neuroptera Coleoptera Mecoptera Trichoptera Lepidoptera Diptera Siphonaptera Hymenoptera	Complete Metamorphosis 

HOW TO MAKE AN INSECT COLLECTION

Once you decide to make an insect collection, you will need to make or buy the following:

- (a) Killing jar
- (b) Collecting net
- (c) Insect pins and cardboard points
- (d) Vials and alcohol
- (e) Storage box or insect display case
- (f) Insect repellents
- (g) Pinning block
- (h) Relaxing jar
- (i) Spreading board

KILLING JAR

Essentially there are two types of insect killing jars suggested:

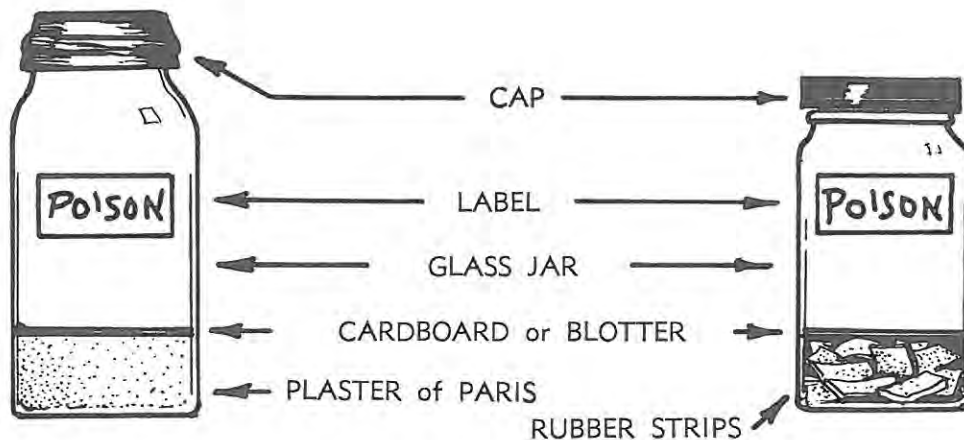
First locate a glass jar with a large mouth and a tight lid. Then put a few pieces of cut-up rubber from rubber bands or inner tubing, in the bottom of the jar. Add ethyl acetate (an ingredient of fingernail polish remover). After 15 to 30 minutes drain off the excess liquid and place

a tight-fitting disc made of cardboard or blotting paper over the saturated rubber.

Plaster of Paris can also be used as an absorbent material. Mix 8 heaping teaspoons of Plaster of Paris with 5 teaspoons of water in a mixing cup. This should make a paste about as thick as a frosted malt drink. Stir the mixture until smooth. Pour or spoon the mixture into a pint killing jar. Tap the killing jar against the ground so the Plaster of Paris makes a smooth surface. With the cap off the jar, let the Plaster of Paris set for one day. When the Plaster of Paris is thoroughly set, pour as much killing agent into the killing jar as will be absorbed by the Plaster of Paris. Pour out any excess liquid that is not absorbed.

If you plan to be in the field collecting for a long period of time, either prepare several killing jars or take along ethyl acetate (available from the drugstore) and recharge the jars as needed.

With a killing jar itself, you can collect the slower moving insects from flowers, beneath boards and rocks and around lights.



COLLECTING NET

In order to collect the fast flying insects a collecting net is essential.

The handle should be grooved on both sides, 2 inches long on one side and 3 inches on the other. Grooves should be deep enough to permit the hoop wire to fit snugly in place. Each groove should end in a hole large enough to receive the end of the wire.

The hoop is composed of a 3- to 4-foot piece of rather heavy wire, about $\frac{1}{8}$ inch diameter, and bent as shown. Make sure that the small turned ends fit exactly into the small holes in the handle. This will prevent the hoop from twisting on the completed net. Then bind the hoop to the handle with tape or wire, or insert a metal collar over the handle to hold the wire hoop in place.

The bag of the net may be made from a variety of cloth materials. A piece 3 feet by 5 feet is usually adequate. The mesh should be coarse enough to allow air to pass through easily as it is swung through the air. However, the mesh needs to be fine enough to prevent the escape of captured insects. The bag should be cone-shaped with a round tip, and twice as long as the diameter of the metal hoop so that when you flip the net over it keeps the insects confined.

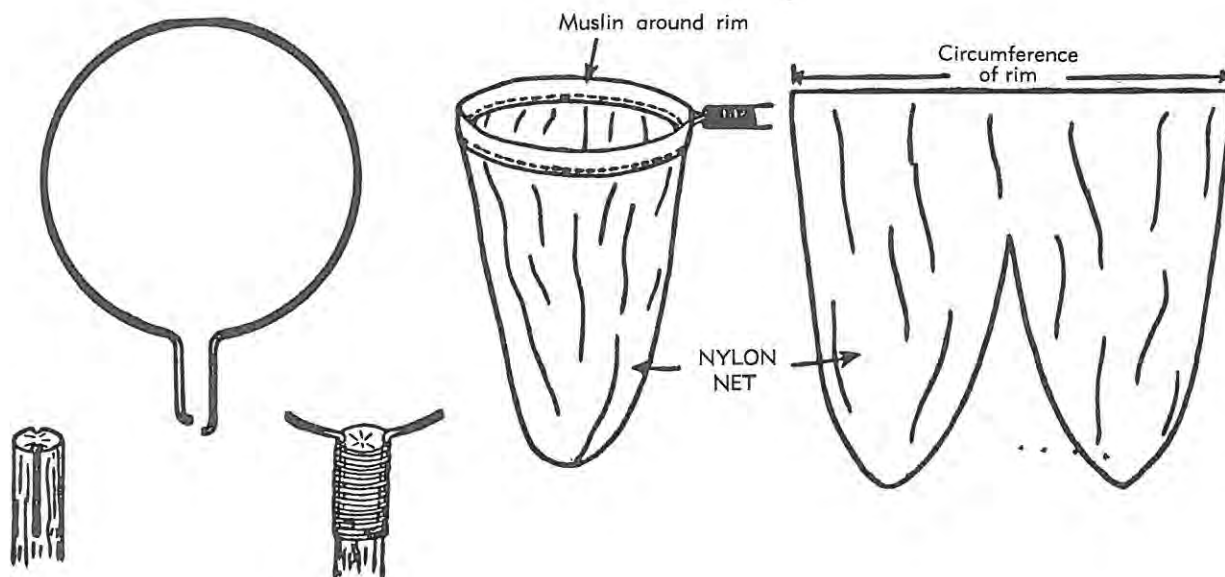
Nylon is the best material for bag construction, as it is light, durable, and will withstand a lot of hard use. It is advisable to reinforce the rim of the bag with a 3-inch strip of heavier material (heavy muslin or light-weight canvas) to prevent excessive wear.

How to Collect Insects With a Net

A special technique should be followed in netting certain insects, especially stinging and "biting" insects like wasps, bees, hornets, assassin bugs and tiger beetles. Sweep the insect into the net and with a quick jerk, force it to the bottom of the bag. Then grasp one hand around the bag just above the captured insect. Insert the end of the bag along with the captured insect into the killing jar. Place the jar lid over the mouth of the jar as tightly as possible and hold it for 30 to 60 seconds until the insect becomes motionless. Remove the end of the net from the jar and put the stunned insect back in the killing jar. Always stand sideways to the wind while opening and handling your killing jar.

Collecting butterflies and moths, without damaging the specimen, also requires special technique and care in handling the net. To prevent butterflies or moths from escaping after being netted, whip the net so the insect goes to the bottom of the bag. Quickly flip the bag bottom making it rest across the wire hoop. Then squeeze the thorax of the butterfly firmly between the thumb and forefinger while it still is in the net. This will stun the insect and prevent it from beating the scales off its wings when it is dropped in the killing jar.

Many insects "play possum" and become inactive when disturbed. To catch these insects, hold your net under plants and shake the insects off into the net, then transfer them into the killing jar.



INSECT PINS AND CARDBOARD POINTS

Pins designed for pinning insects are available and should be used where possible. As a rule, #2 or #3 pins are most suitable for general collections. Insects such as mosquitoes are very small and should be placed on cardboard points.

Insect pins may be obtained from most college or university bookstores. Check with your local leader for the nearest source of supply. Do not use common pins, since they will rust and soon ruin what may be valuable specimens.

Cardboard points are 3/8-inch long triangle of light cardboard. A drop of glue put on the point will hold the insect. Put the pin through the wide end of the point. Insects mounted in this way face forward and are on the left of the pin. Points are available free from Extension 4-H Entomologist, North Carolina State University, Raleigh, NC, 27695-7613.

VIALS AND ALCOHOL

Some soft-bodied insects, such as aphids, and the immature stages such as maggots, grubs, and caterpillars, should be placed in vials and covered with 70-percent alcohol. Be sure the vials have tight caps or corks. Rubbing alcohol may be used if no other is available. If these vials are added to a collection of pinned insects, be sure that they are securely fastened to the bottom of the box.

STORAGE BOX OR INSECT DISPLAY CASE

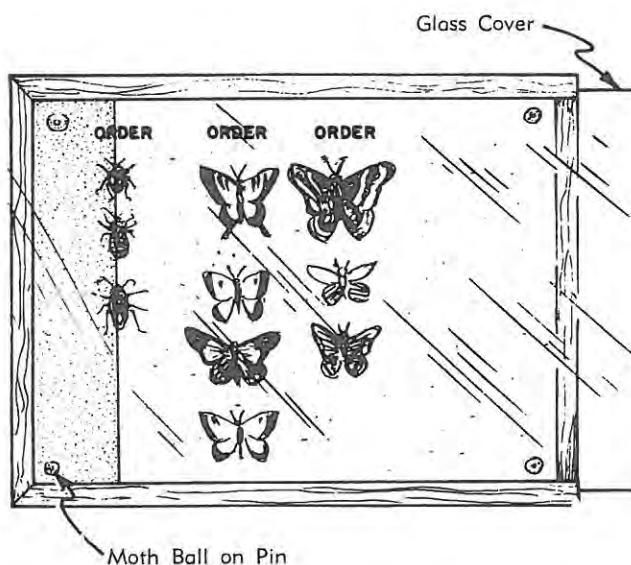
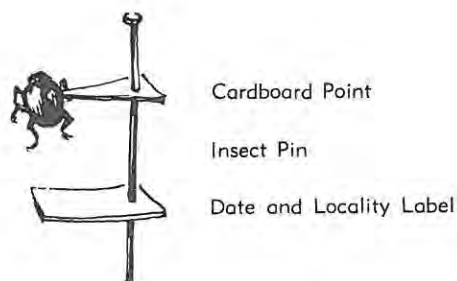
A good storage box is necessary, since dead insects are subject to attack by other insects and mice. Cigar boxes are very good for temporary storage. Cut a piece of corrugated cardboard or some soft material which pins will stick into. Place it on the bottom of the cigar box and then cover it with a sheet of white paper.

The recommended size case is one that will take a glass cover 18 x 24 inches (standard size glass). Therefore, the case should be approximately 18 1/2 x 24 1/2 x 3 inches, with a Celotex or soft-board bottom into which pins may be inserted.

For those desiring to make their own box, either at home or as a workshop project at school, write to: Extension 4-H Entomologist, North Carolina State University, Raleigh, NC, 27695-7613. Ask for insect display case plan #2532.

The recommended size insect display case may be used at fairs such as the Dixie Classic in Winston-Salem and the N.C. State Fair in Raleigh.

To show your collection to best advantage, it should be arranged in the display case as shown.

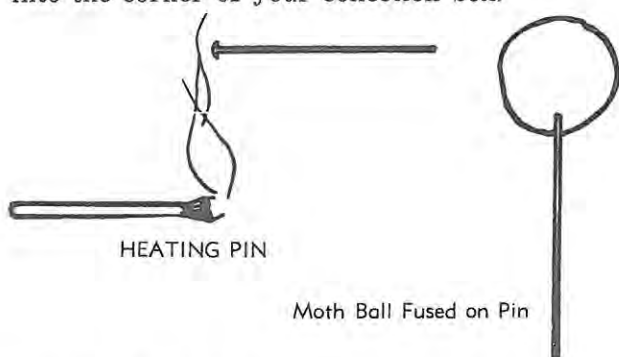


INSECT REPELLENTS

Mice like dead insects, therefore keep the cover in place when you are not working with your collection. Other insects also attack dead insects in collections; so, take some preventive precautions.

Paradichlorobenzene crystals (regular moth crystals sometimes called PDB) are good for preventing infestations. They must be placed in a small box in one corner of the collection box and replenished when necessary. An ordinary mothball also works well.

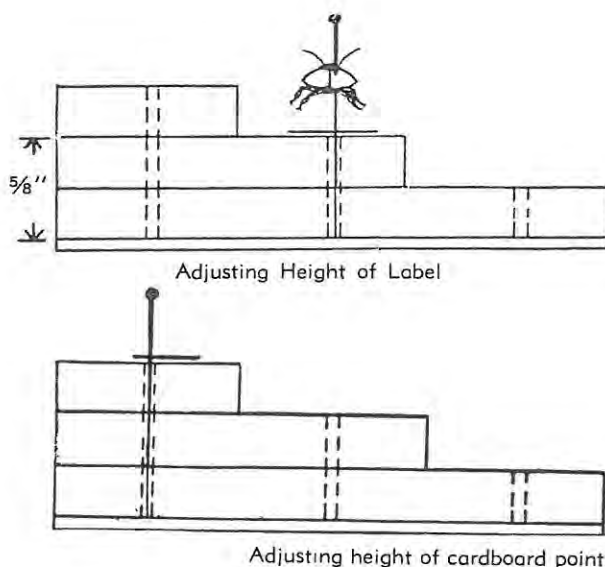
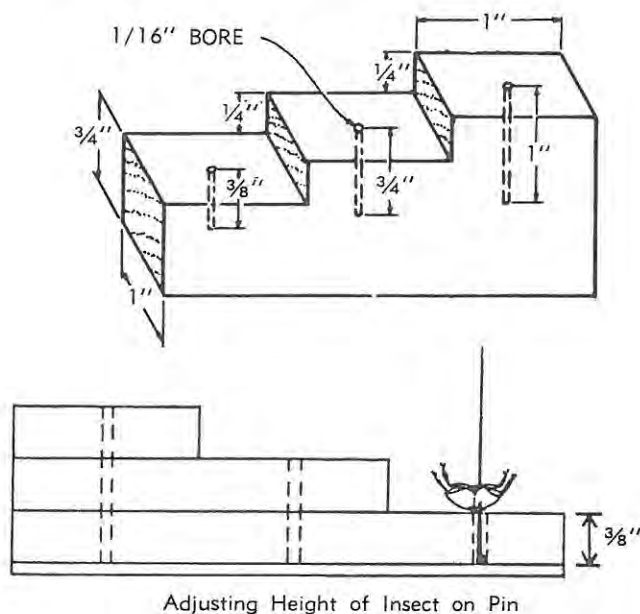
The head of a common pin, heated with a lighted match (by holding the point of the pin with a pair of pliers), can be inserted directly into the mothball. The mothball will melt around the pin head and, when it hardens may be pinned into the corner of your collection box.



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PINNING BLOCK

The appearance of your insect collection can be improved by using a pinning block. This block is made in steps which allow the worker to keep all the insects the same height on the pin and also get all the labels at the same level.

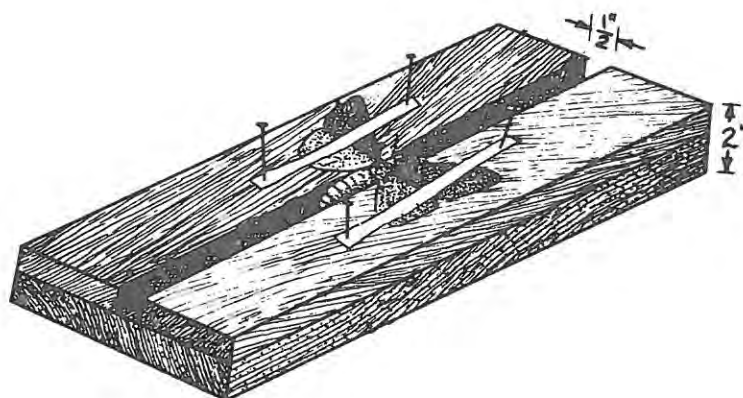


RELAXING JAR

If insects become hardened before they are pinned, relax them by putting them in a saucer or shallow dish placed on moist sand within a larger closed container. If left too long, molds may develop. Avoid having to use a relaxing jar except for very valuable insects.

SPREADING BOARD

This piece of equipment is used to spread the wings of certain groups of insects so that their beauty is displayed and so that the veins of the wings can be easily seen and used for proper identification. To make a spreading board, take two boards separated by a 1/4 to 1/2 inch space, place soft material such as balsa wood in the bottom of the slot. You may want to make the center slot or "trough" wide at one end to accommodate insects of different sizes.



WHERE TO PIN INSECTS

Insect pins may be obtained from most college or university bookstores.

Pins come in several sizes, but No. 2's and No. 3's will be found the most useful.

Any insect that is large enough to support a pin without breaking or otherwise being distorted may be pinned directly through the body. Insert the pin through a definite part of the body from top to bottom as shown. The place of insertion depends upon the type of insect. The following rules have been set up for pinning different types of insects so that the pin may be placed firmly through the heavier parts of the body. (See black dot.)

1. Bees, wasps, flies, etc.: Pin through the thorax between bases of fore wings and just to right of middle line (B); e.g., *DIPTERA*.

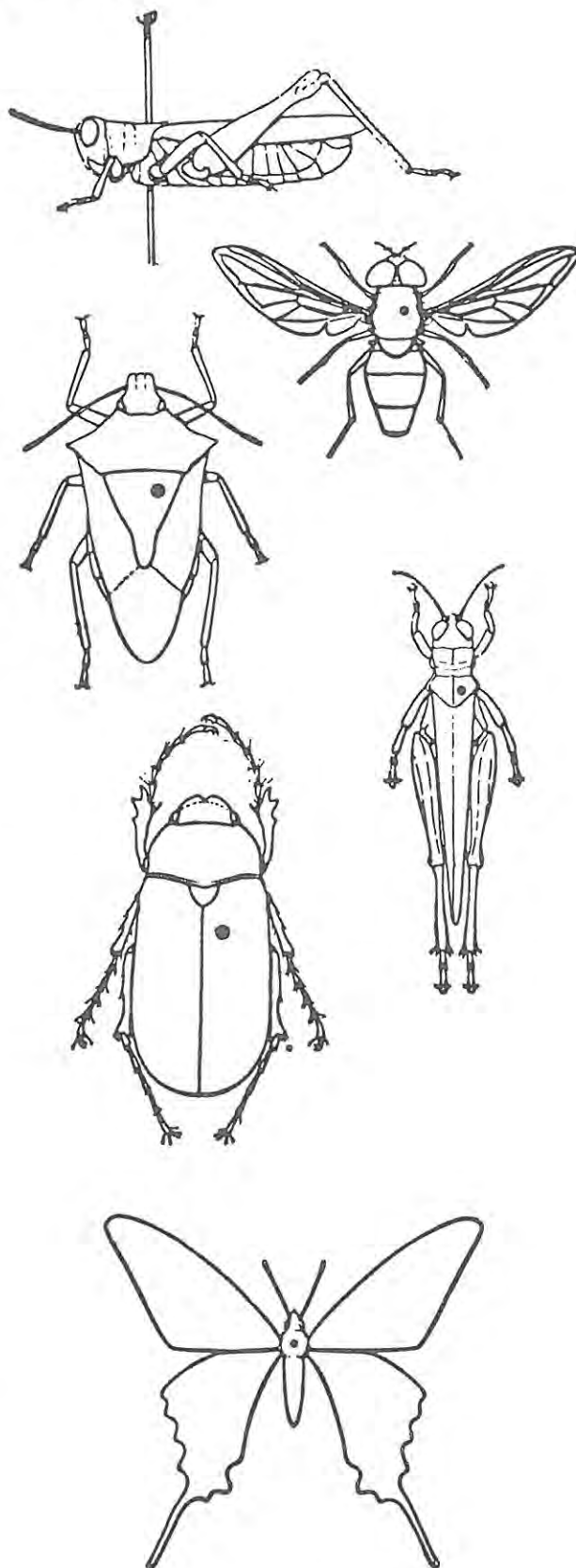
2. True bugs: Pin through the scutellum, which is the triangular area between the bases of the wings (C); e.g., *HEMIPTERA*.

3. Grasshoppers, crickets, etc.: Pin through the prothorax or "saddle" just to the right of the center line (D); e.g., *ORTHOPTERA*.

4. Beetles: Pin through the fore part of the right wing cover near the center line (E); e.g., *COLEOPTERA*.

5. Butterflies, moths, dragonflies, etc.: Pin through center of thorax between the bases of fore wings (F); e.g., *LEPIDOPTERA*.

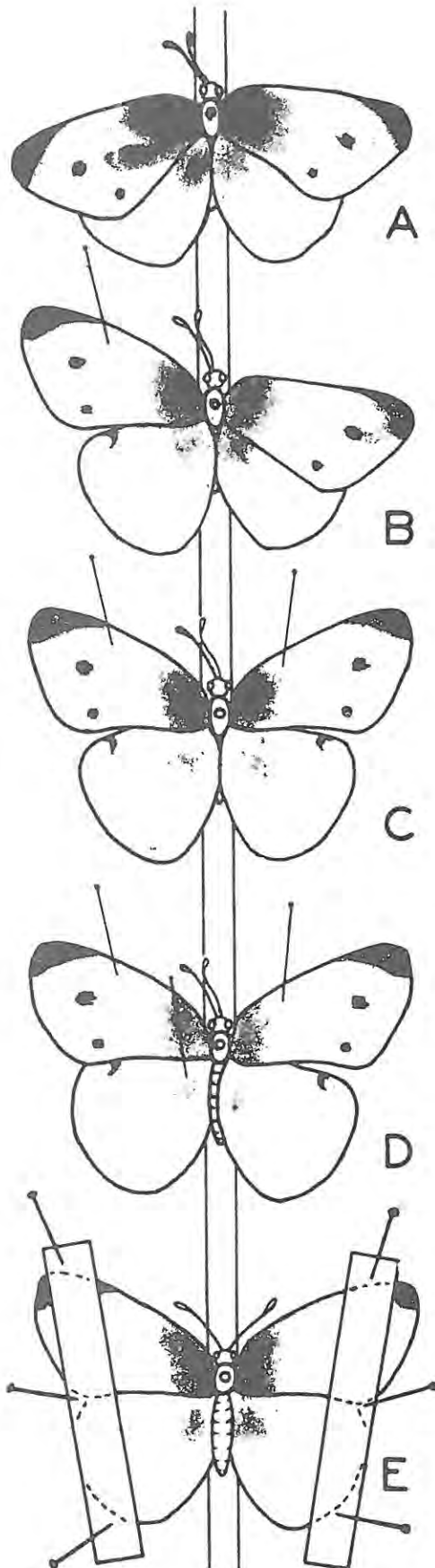
Three-eighths of an inch of the pin should project above the insect to facilitate handling the specimen. Use a pinning block to measure this distance.



Black dot indicates where to pin.

HOW TO SPREAD MOTHS, BUTTERFLIES, ETC.

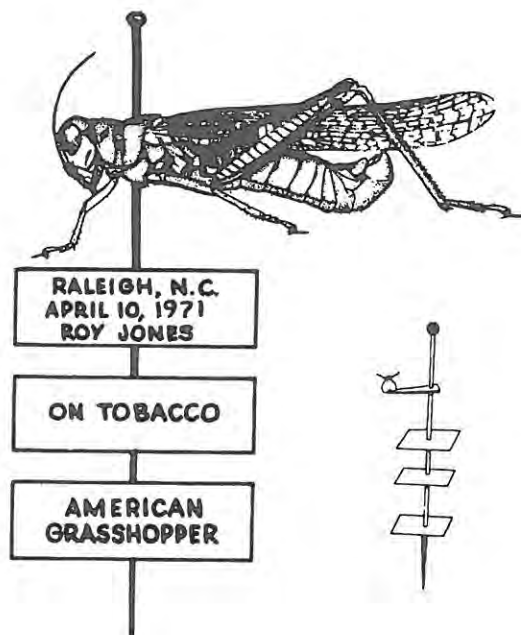
Pin the insect through the center of the thorax. Place the pinned insect with the body in the "trough" of the spreading board. Then work the wings into position (A to E). Pull front wings up until hind margins are at right angles to the body, then pull front margin of each hind wing up to it and pin in place. Place paper strips over the wings and pin through these to prevent wing damage by the pins. Under good drying conditions insects can be removed or taken from the spreading board in 4 or 5 days and the wings will remain in place.



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

HOW TO LABEL INSECTS

Use a small label $\frac{1}{2}$ inch wide and one inch long. On the label write where the insect was collected, the date it was collected, and the name of the collector. Place labels at the desired height on the pin by means of the pinning block. Remember, a specimen without a date and locality label is practically worthless. Only the above information is required for 4-H Entomology I collections. In Entomology II and III, additional labels are required.



WHERE TO LOOK FOR INSECTS

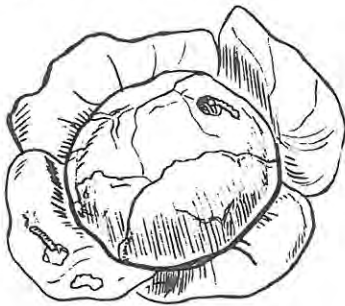
Now that you have learned what equipment is needed and how to use it, you are ready to collect insects. Look . . .



In the air for flying insects on warm days from early spring to late fall.



On (or in) fresh or decaying fruit.



On a wide variety of vegetation, both day and night.



Around street lights, porch lights and study lamps.



On domestic animals for parasitic insects, such as fleas and lice.



Along the edges of rivers, streams, lakes or ponds and in the water.



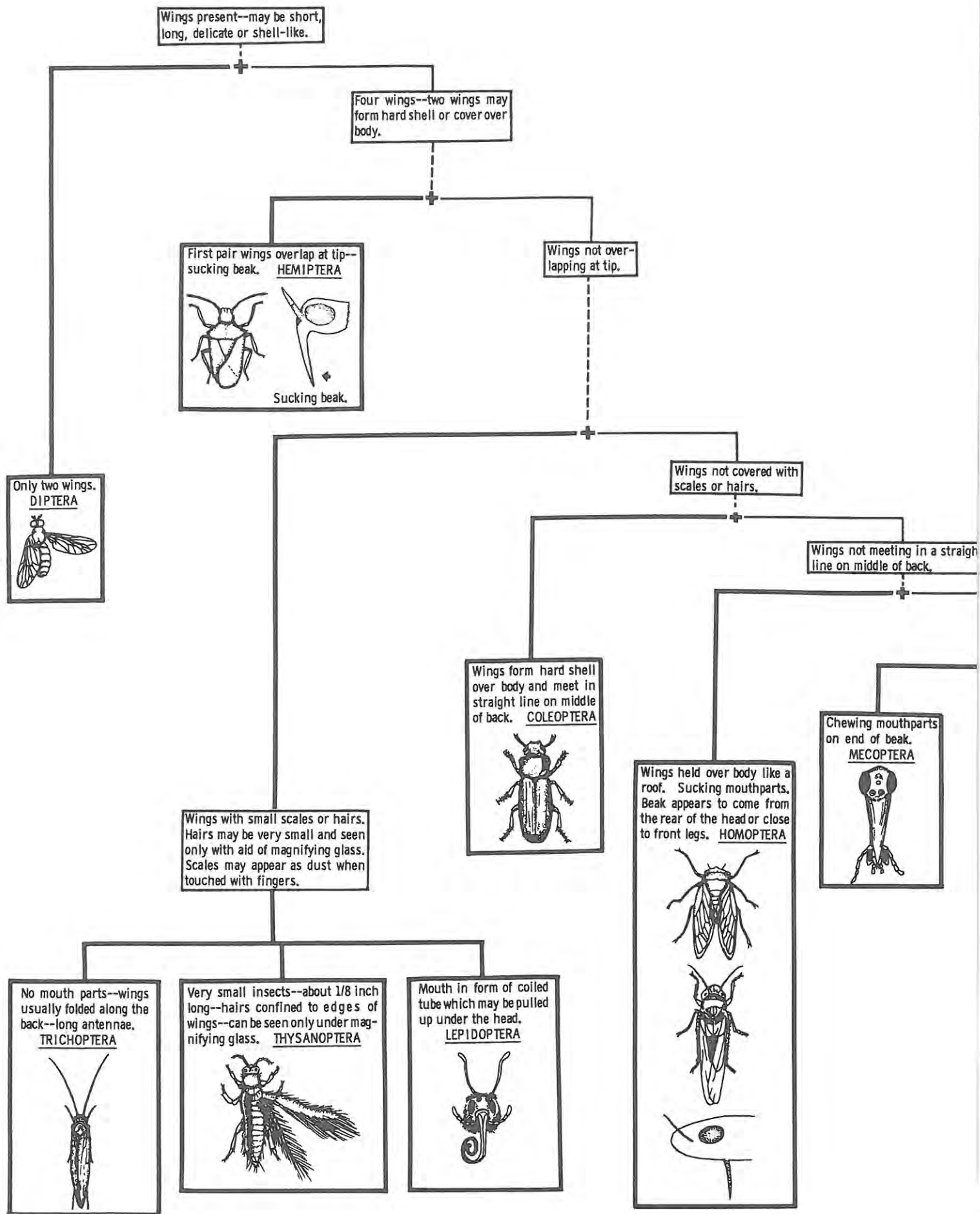
In woodpiles, especially in spring and early summer.



In the soil.



In windows, flour bins, cereal packages, and closets or boxes where clothing and old papers are stored.



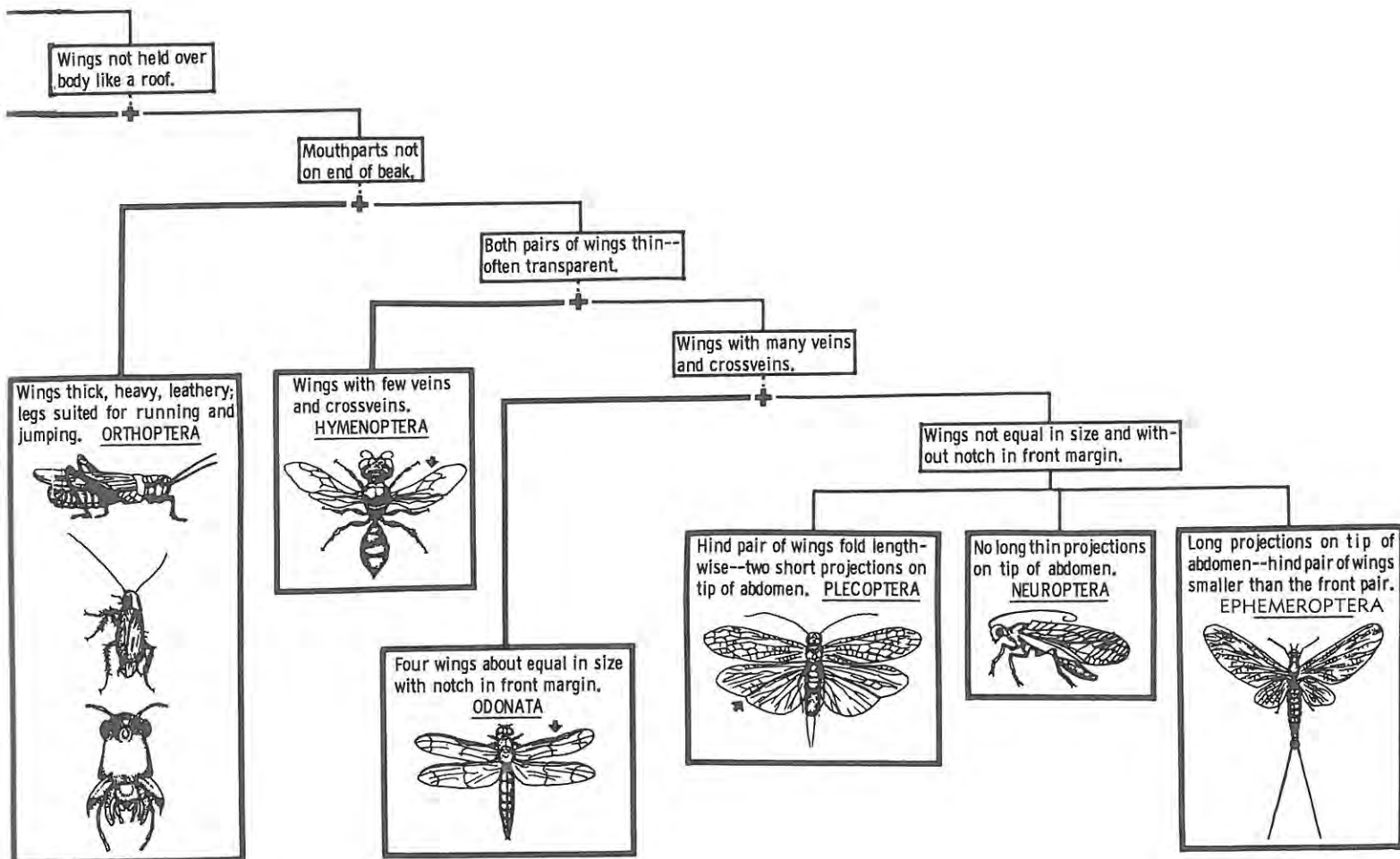
KEY TO ADULT INSECT ORDERS Winged

HOW TO USE THIS KEY

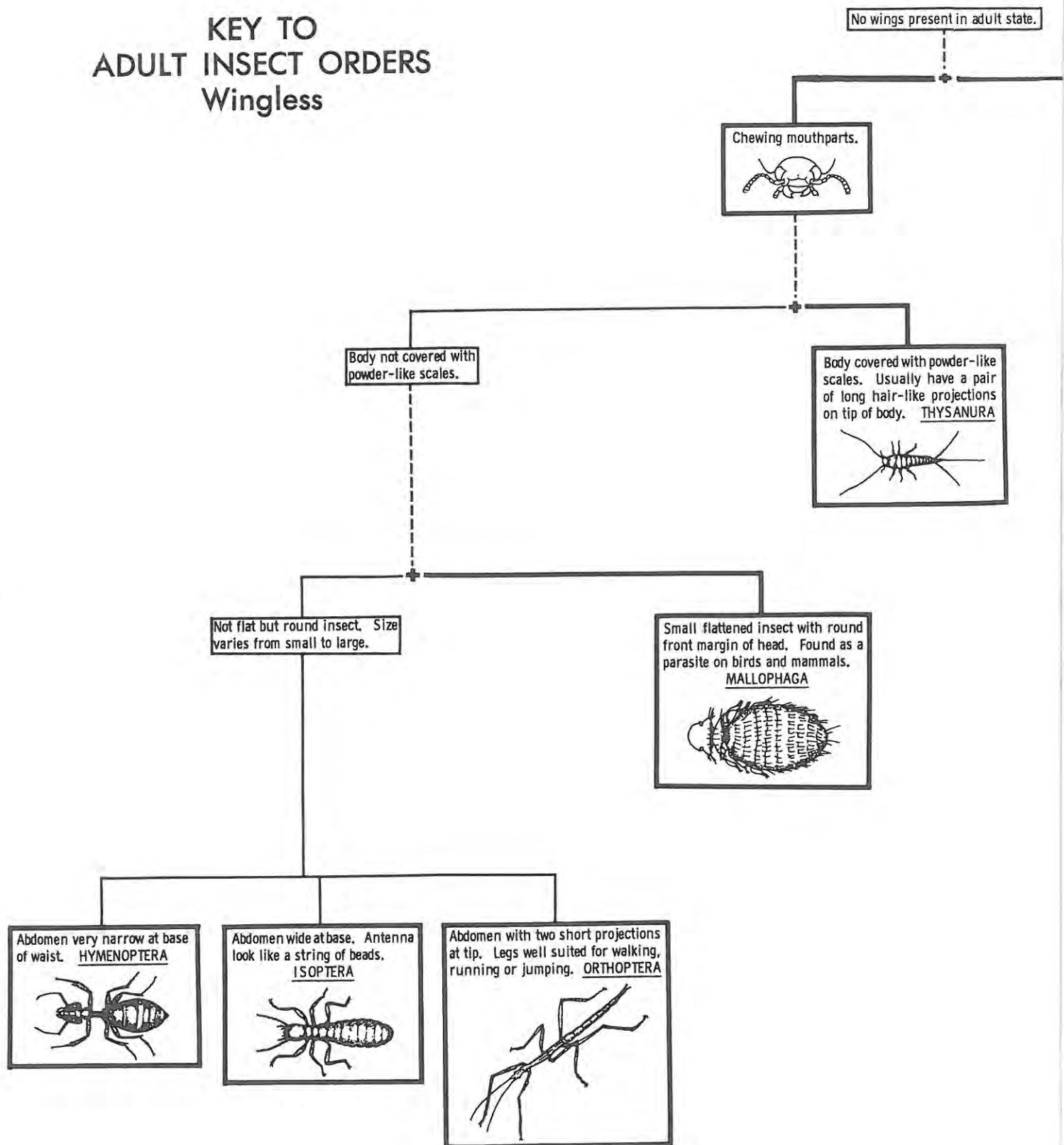
This key is designed to help identify only adult insects so make certain you have an adult insect. Special keys are required to identify immature insects.

If the insect has wings—use this key. If the insect is without wings use the key on pages 12 and 13. Insect wings vary in their appearance from very delicate membranes to hard-leathery shell-like structures. Starting at the top, follow the broken line to the crossroad (+). At the crossroad you must go either one of two or three ways. Always try the heavy line first. If the description fits your specimen and an Order name is in the box, you have identified your specimen. If the description does not fit your specimen, then go back to the crossroad (+) and take the other road. This description should fit your specimen. Continue following the line to the next crossroad and repeat the procedure by again taking the heavy line to the Order.

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KEY TO ADULT INSECT ORDERS Wingless



Note: If the insect has no wings, use this key. If the insect has wings, use the key on pages 10 and 11.

Instructions on how to use this key are on page 11.

Mouthparts not chewing--
may be piercing, sucking
or siphoning.



Body flattened sideways (compressed).
Legs are fitted for jumping. Small dark-
colored insects. SIPHONAPTERA



Body not flattened sideways.
Legs not fitted for running
or jumping.

Mouthparts have a long beak.

Mouthparts not jointed. May be
fleshy or beak may appear absent.

Antennae not hidden in pits but
visible from above. Legs have one
claw. ANOPLURA



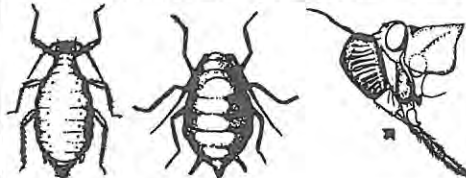
Antennae hidden in pits of head--
not seen from above. Body looks
like a tick. DIPTERA



Beak projects from the front part of head.
HEMIPTERA



Beak appears to come from the rear of the head or close
to front of legs. HOMOPTERA



HOW TO IDENTIFY AND CLASSIFY INSECTS

The first step in classifying or organizing is to place the insects that look alike in groups called Orders. Be sure to check the Order characteristics of each insect because some that look somewhat alike may be distinctly different in structure. For 4-H Entomology I you need only classify to Order.

Classify a few of the common insects to Family, Genus, and species as noted in Entomology II and III. Place the name of the Order at the beginning of each group of insects.

Remember! Always know what insect you are dealing with before you attempt any research work or give any control recommendation.

SCORPIONFLIES—ORDER MECOPTERA

(Long Wings)

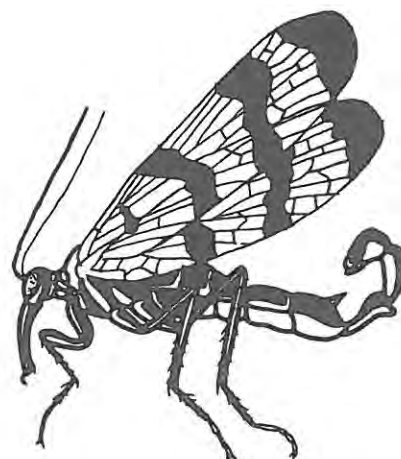
Order Characteristics

Wings—Two pairs—Both pair fairly long with many veins.

Mouthparts—Chewing

Metamorphosis—Complete

Comments—The chewing mouthparts are at the end of the long trunk-shaped head.



FLEAS—ORDER SIPHONAPTERA

(Tube; without Wings)

Order Characteristics

Wings—Absent

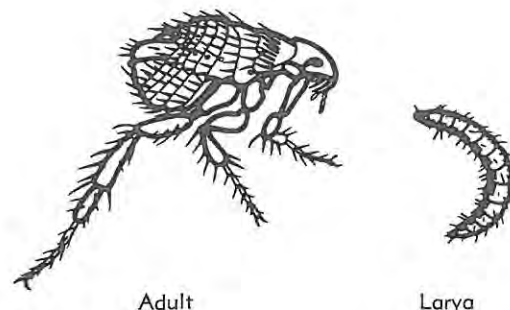
Mouthparts—

Adult—Piercing-Sucking

Larva—Chewing

Metamorphosis—Complete

Comments—Body laterally compressed (flattened)
Hind legs long and suitable for jumping. Many spines on the body.



Adult

Larva

CADDISFLIES—ORDER TRICHOPTERA

(Hair Wings)

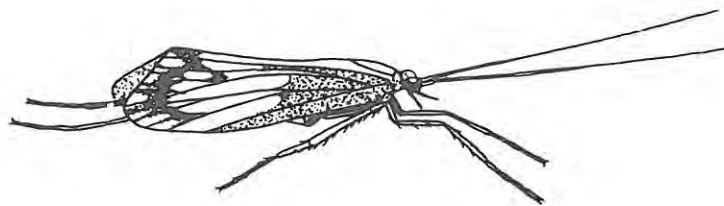
Order Characteristics

Wings—Two pairs—All membranous, covered with short hairs. Held roof-like when at rest. Bottom wings are broader and shorter than the top pair.

Mouthparts—Chewing

Metamorphosis—Complete

Comments—Larvae live in water. Adults are very numerous near water. Have long slender antennae.



GRASSHOPPERS, ETC.—ORDER ORTHOPTERA

(Straight Wings)

Order Characteristics

Wings—Two pairs

Top pair—Leathery, straight and held roof-like when at rest in many species

Bottom pair—Membranous and often folded

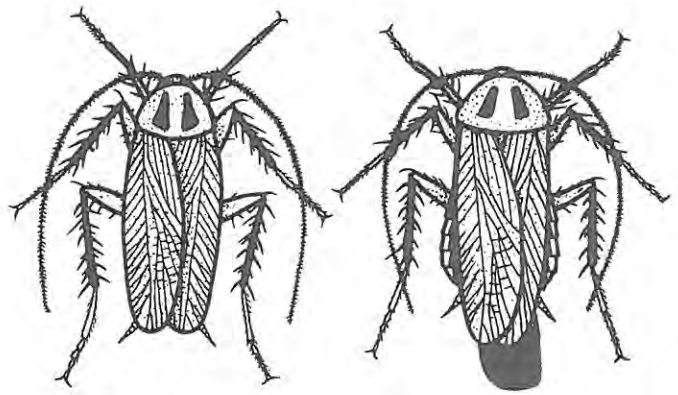
Mouthparts—

Adult—Chewing

Nymph—Chewing

Metamorphosis—Gradual

Comments—There are about 250 species in our state. Many of these are very destructive.



German Cockroaches

Some Other Common Orthopterons

Long-horned grasshoppers

Katydids

Cone-headed grasshoppers

Cave and camel crickets

Field crickets

House crickets

Tree crickets

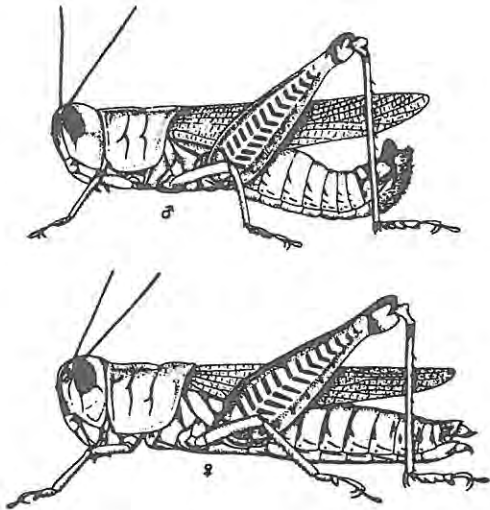
American cockroach

Oriental cockroach

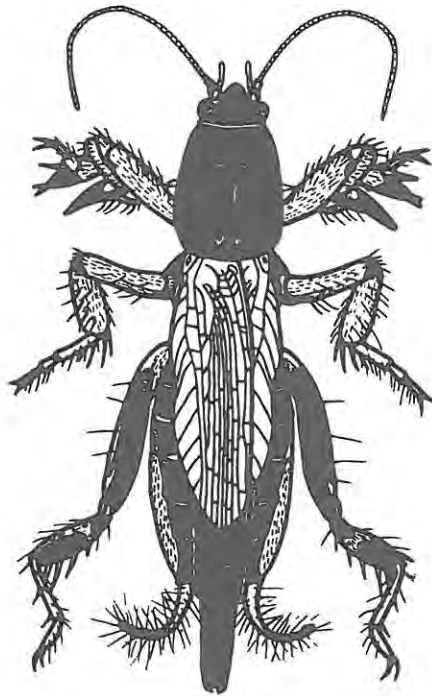
Brownbanded cockroach

Walking sticks

Praying mantis



Grasshoppers



Mole Cricket

TRUE BUGS—ORDER HEMIPTERA

(Half Wings)

Order Characteristics

Wings—Two pairs

Top pair—Basal half leathery and outer half
Membranous

Bottom pair—All membranous

Mouthparts—

Adult—Piercing-Sucking

Nymph—Piercing-Sucking

Metamorphosis—Gradual

Comments—Of all insects only members of this
Order may be rightly called bugs.

Some Other Common True Bugs

Four-lined plant bugs

Stink bug

Chinch bug

Bed bugs

Leaf-footed bugs

Water boatmen

Water striders

Back-swimmers

Flat bugs

Stilt bugs

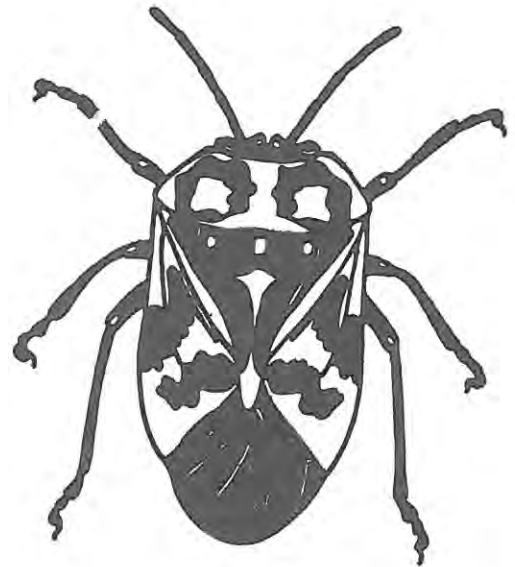
Boxelder bug

Ambush bug

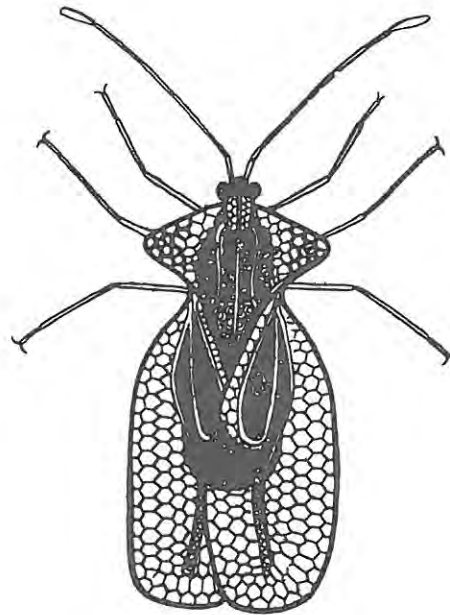
Damsel bugs

Assassin bugs

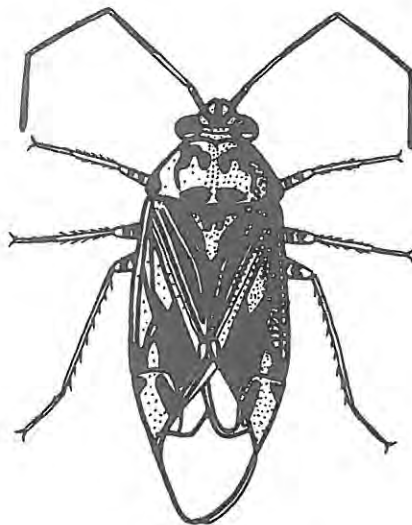
Giant water bugs



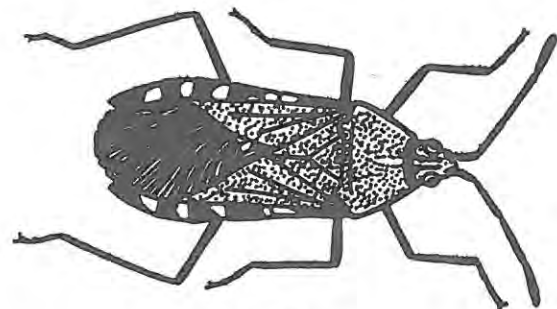
Harlequin Bug



Lace Bug



Tarnished Plant Bug



Squash Bug

APHIDS (Plant Lice) ETC.—ORDER HOMOPTERA
(Like Wings)

Order Characteristics

Wings—Two pairs

Top pair—Same texture throughout

Bottom pair—Membranous

Mouthparts—

Adult—Piercing-Sucking

Nymph—Piercing-Sucking

Metamorphosis—Gradual

Comments—Many members of this Order secrete a sugar-containing solution called "honeydew".

Some Other Common Bugs

Buffalo treehopper

Spittlebugs

Lanternflies

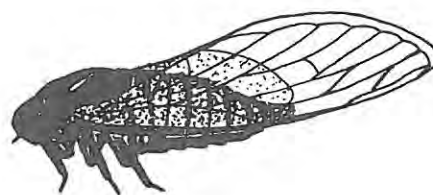
Jumping plantlice

Scale insects

Woolly aphids

Grape phylloxera

Mealybugs



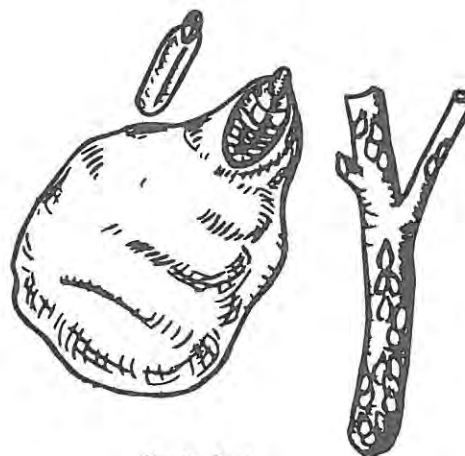
Cicada



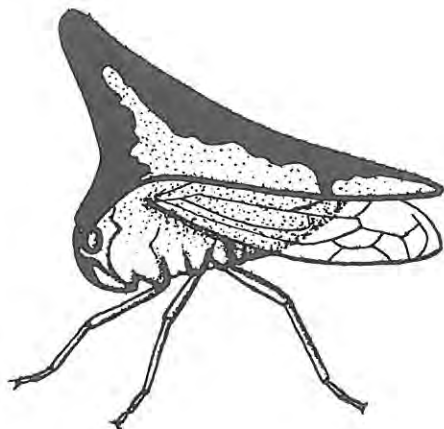
Whitefly



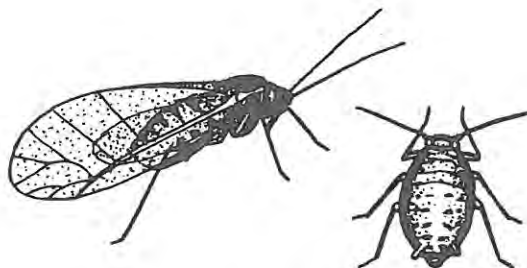
Leafhopper



Scurfy Scale



Treehopper



Aphids or Plant Lice

MOTHS, BUTTERFLIES AND SKIPPERS—ORDER LEPIDOPTERA

(Scale Wings) **Order Characteristics**

Wings—Two pairs—Both covered with scales

Mouthparts—

Adult—Siphoning (Sucking type)

Larva—(Caterpillar)—Chewing

Metamorphosis—Complete

Comments—Color is carried in scales. Scales are easily rubbed off. There are over 1200 different moths and butterflies in North Carolina.

Some Other Common Moths, Butterflies, and Skippers

Mourning cloak butterfly

Monarch butterfly

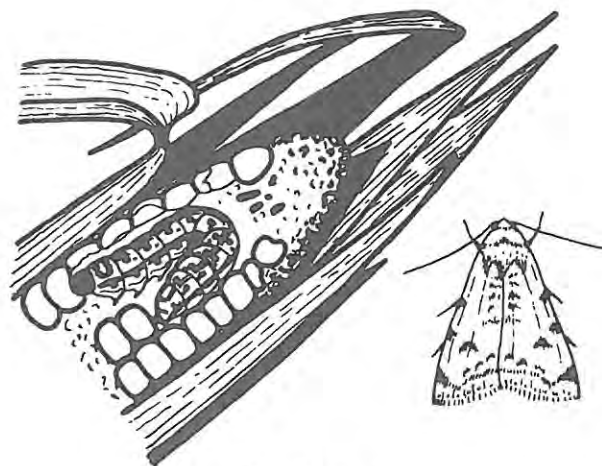
Sulphur butterflies

Silver spotted skipper

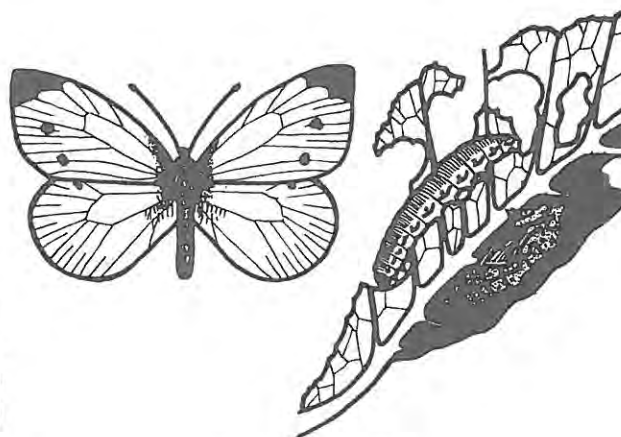
Hairstreaks

Viceroy butterfly

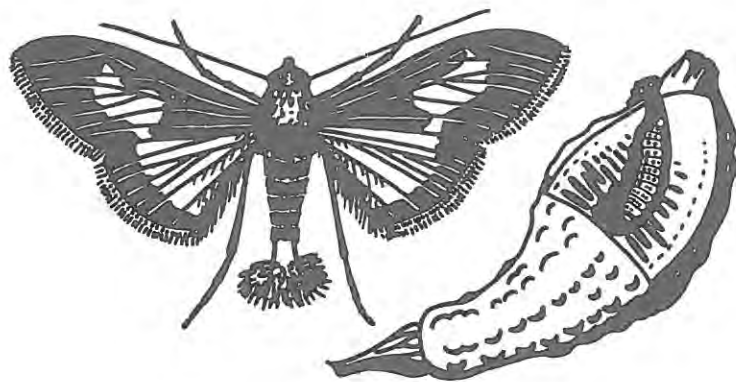
Tobacco budworm



Corn Earworm



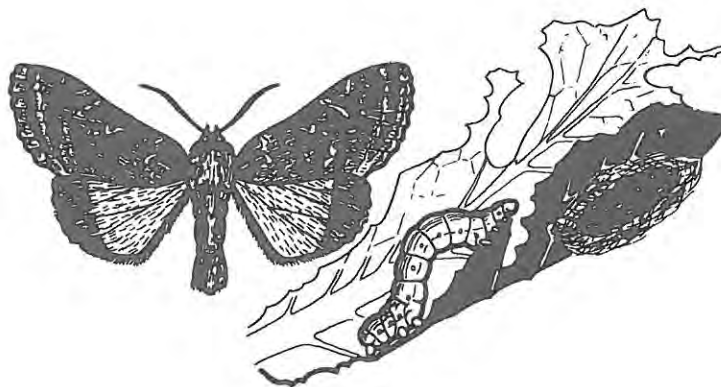
Cabbage Butterfly



Pickleworm



Squash Vine Borer



Cabbage Looper

BETLES—ORDER COLEOPTERA

(Sheath Wings)

Order Characteristics

Wings—Two pairs

Top pair—Shell-like

Bottom pair—Membranous

Mouthparts—

Adult—Chewing

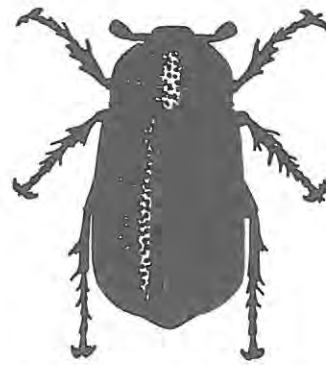
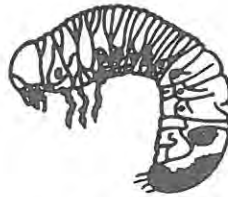
Larva (Grub, etc.)—Chewing

Metamorphosis—Complete

Comments—This is our largest Order having over 3000 different species in the state.



White Grub



June Beetle

Some Other Common Beetles

Striped cucumber beetle

Spotted cucumber beetle

Whitefringed beetle

Blister beetles

Bark beetles

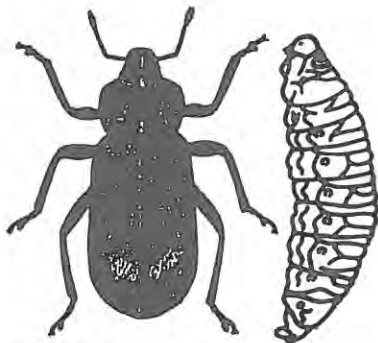
Ladybird beetles

Carrion beetles

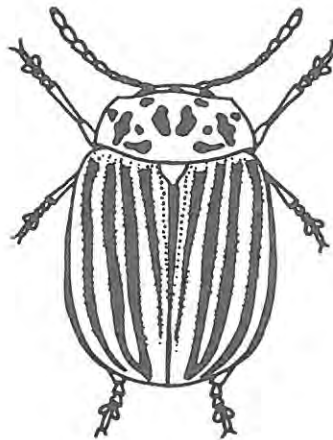
Ground beetles

Long-horned beetles

Rice weevil



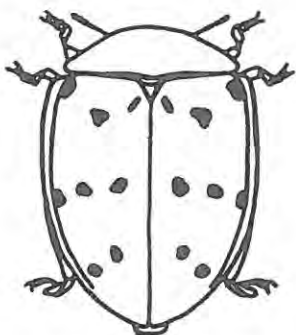
Vegetable Weevil



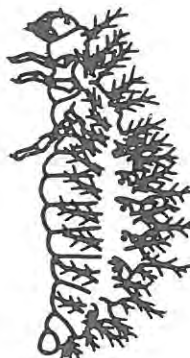
Colorado Potato Beetle



19



Mexican Bean Beetle



Wireworm



Click Beetle

FLIES—ORDER DIPTERA

(Two Wings)

Order Characteristics

Wings—One pair only—Membranous

Mouthparts—

Adult—Piercing-Sucking

(Mosquito)

Sponging (Housefly)

Larva (Maggot)—Mouth Hooks

Metamorphosis—Complete

Comments—There are about 2000 species of flies in North Carolina. Characteristics of the Order are quite variable.

Some Other Common Flies

Soldier flies

Craneflies

Fungus gnats

March flies

Midges

Gall gnats

Black flies

Horse flies

Deer flies

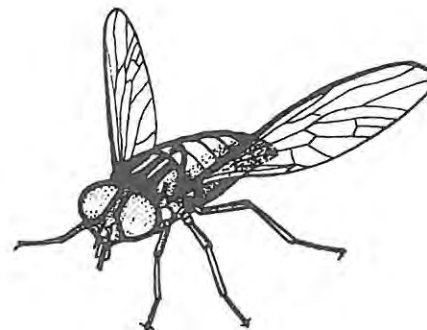
Stable flies

Bot flies

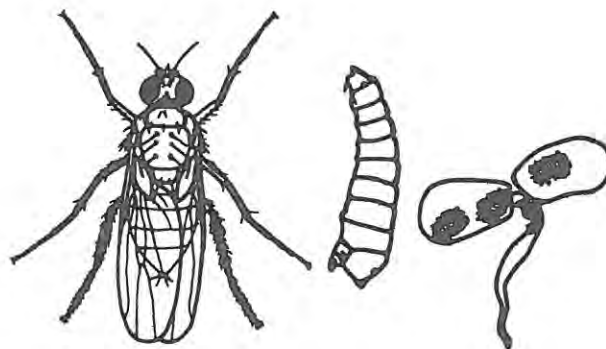
Blow flies

Flesh flies

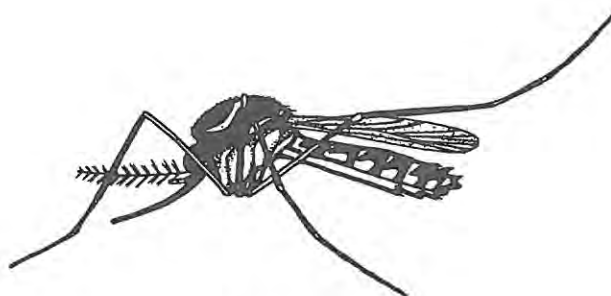
Louse-like flies



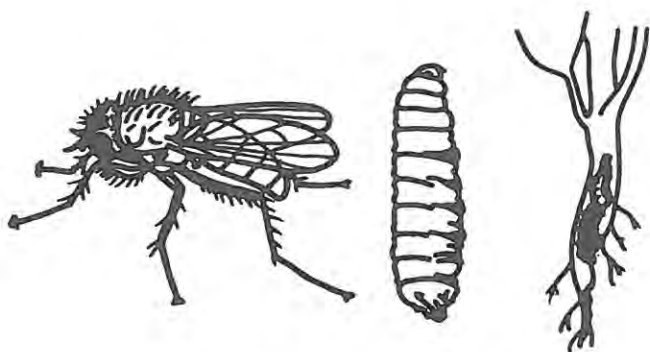
Horse Fly



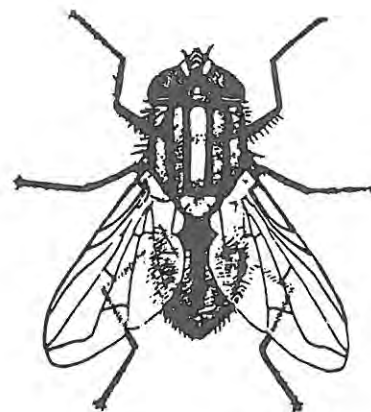
Seedcorn Maggot



Mosquito



Cabbage Maggot



House Fly

**BEEs, WASPS, AND ANTS—ORDER
HYMENOPTERA**

(Membrane Wings)

Order Characteristics

Wings—Two pairs—Both membranous

Adult—Chewing-Lapping—Or chewing

Larva—Mostly Chewing

Metamorphosis—Complete

Comments—Many of our most useful insects are
in this large Order of over 1800 species.

Some Other Common Hymenopterons

Carpenter ants

Sweet-loving ants

Grease-loving ants

Social wasps

Hornets

Ichneumonflies

Braconidflies

Sawflies

Cynipid wasps

Chalcidflies

Cuckoo wasps

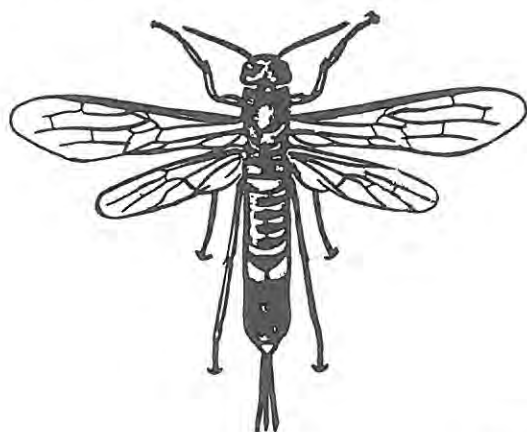
Velvet ants

Bumble bees

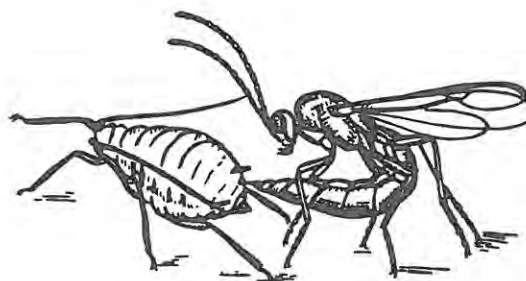
Leaf-cutter bees



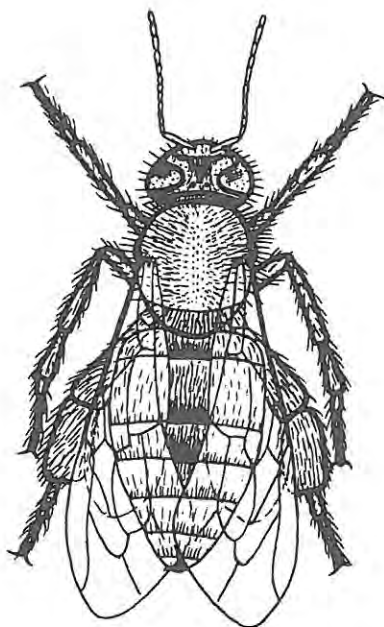
Solitary Wasp



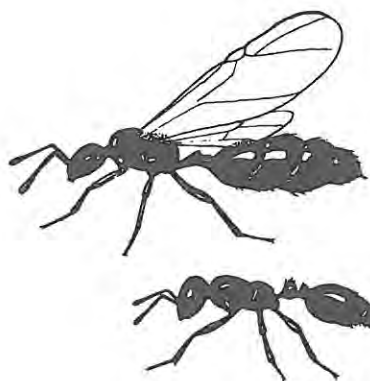
Horntail



Wasp Stinging Aphid



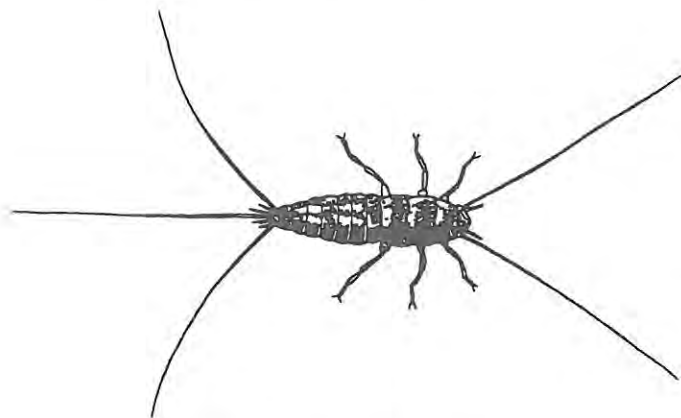
Honey Bee



Ants

BRISTLE TAILS—ORDER THYSANURA
(Bristle Tails)
Order Characteristics

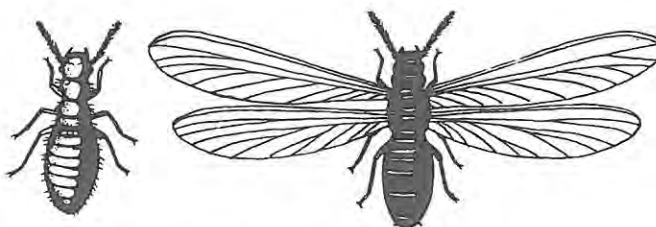
Wings—Absent
Mouthparts—Chewing
Metamorphosis—None
Comments—Body carrot shaped and covered with scales. Three tails on end of abdomen.



Firebrat (Silverfish are Similar)

TERMITES—ORDER ISOPTERA
(Equal Wings)
Order Characteristics

Wings—Two pairs—Approximately equal size on kings and queens at swarming time. Absent on workers.
Mouthparts—Chewing
Metamorphosis—Gradual
Comments—These are social insects in which castes are reproductives, workers, and soldiers.

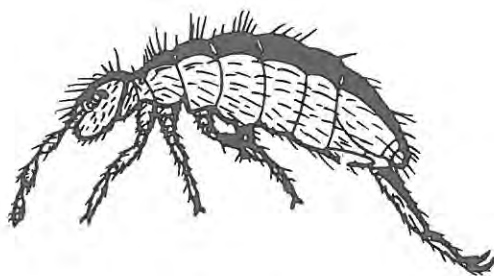


Wingless and Winged Termites

22

SPRINGTAILS, ETC.—ORDER COLLEMBOLA
(Glue Bar)
Order Characteristics

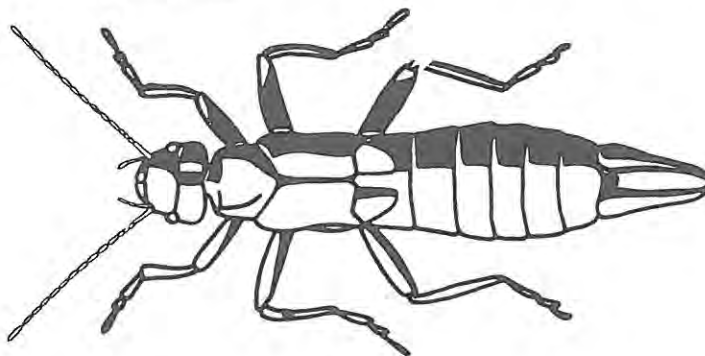
Wings—Absent
Mouthparts—Chewing
Metamorphosis—None
Comments—Frequently associated with cess pools and damp soil. Spring-like process on end of abdomen of most.



Springtail

EARWIGS—ORDER DERMAPTERA
(Skin Wings)
Order Characteristics

Wings—Two pairs or wingless
Top pair—Very short and leathery
Bottom pair—Membranous
Mouthparts—Chewing
Metamorphosis—Gradual
Comments—Cerci (forcep-like structures) on tip of abdomen.



Earwig

PSOCIDS—ORDER PSOCOPTERA
(Muscle Wings)

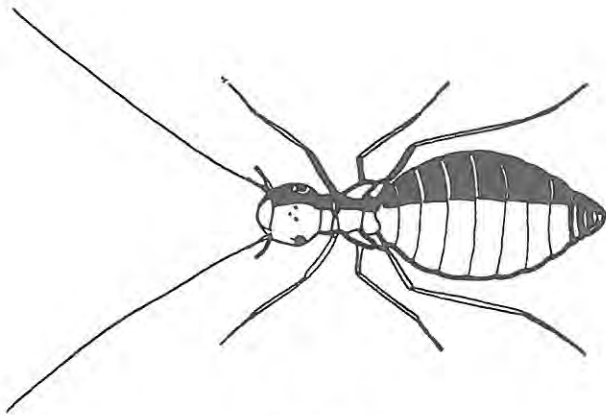
Order Characteristics

Wings—Some wingless, others with two pairs of membranous wings, folded roof-like when at rest.

Mouthparts—Chewing

Metamorphosis—Gradual

Comments—Booklice feed only on fungi, etc.



Booklouse

DRAGONFLIES, ETC.—ORDER ODONATA
(Toothed)

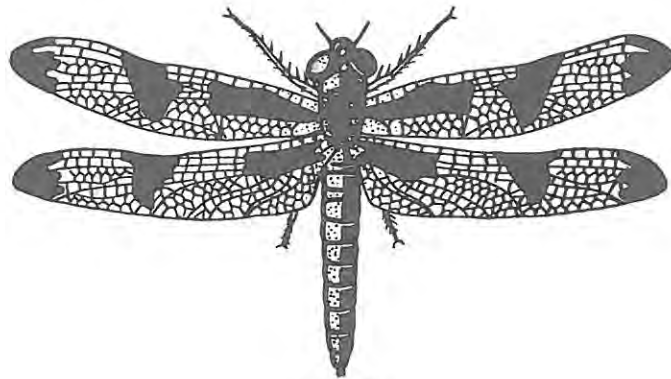
Order Characteristics

Wings—Two pairs—Both pair long, narrow and net-veined. Some with color markings.

Mouthparts—Chewing

Metamorphosis—Incomplete

Comments—The nymphs live in water and many have a scoop-like lower lip.



Dragonfly

THRIPS—ORDER THYSANOPTERA
(Fringe Wings)

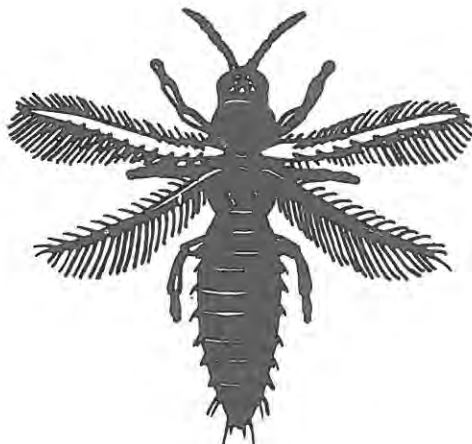
Order Characteristics

Wings—Two pairs—Long and narrow with fringe of hair on both edges.

Mouthparts—Rasping-Sucking

Metamorphosis—Gradual

Comments—Small louse-like insects



Thrips

MAYFLIES—ORDER EPHEMEROPTERA
(Lasting-but-a-day Wings)

Order Characteristics

Wings—Two pairs—Net-veined. Top pair much larger than bottom or hind pair. Held at a vertical angle to body when at rest.

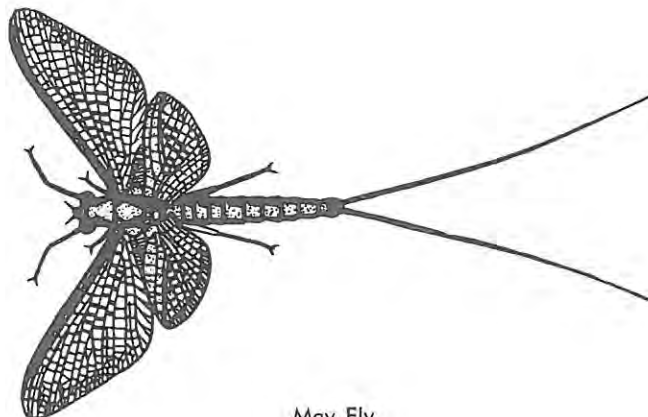
Mouthparts—

Adult—Degenerate

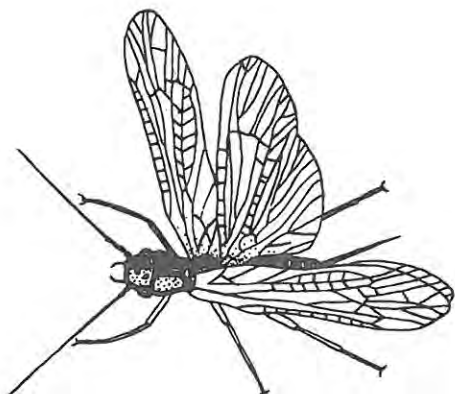
Naiads—(Nymphs)—Chewing

Metamorphosis—Incomplete

Comments—The adults live about 24 hours. The young live in water. Adults have long tail filaments.



May Fly



STONEFLIES—ORDER PLECOPTERA

(Plaited Wings)

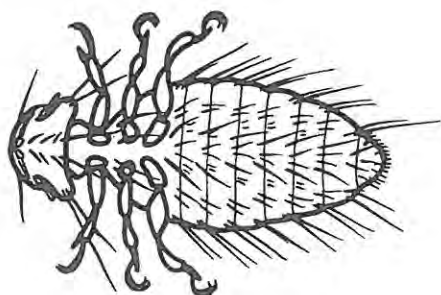
Order Characteristics

Wings—Two pairs—Top pair narrow and net veined. Bottom pair broad and folded like a fan.

Mouthparts—Chewing

Metamorphosis—Incomplete

Comments—Wings when at rest overlap like pages in a book.



BITING LICE—ORDER MALLOPHAGA

(Wool-eating)

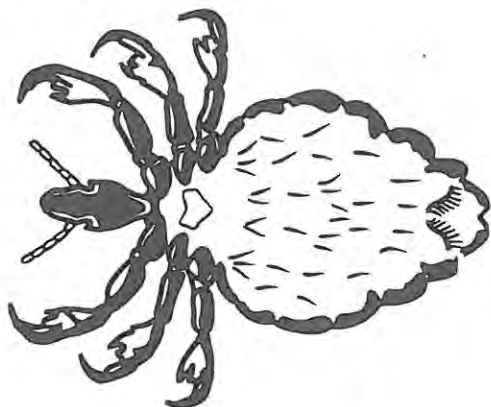
Order Characteristics

Wings—Absent

Mouthparts—Chewing

Metamorphosis—Gradual

Comments—These broad-headed lice are often referred to as bird lice.



SUCKING LICE—ORDER ANOPLURA

(Unarmed Tail)

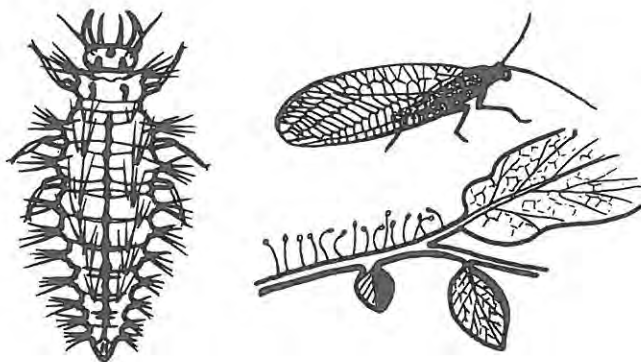
Order Characteristics

Wings—Absent

Mouthparts—Piercing-Sucking

Metamorphosis—Gradual

Comments—Narrow-headed lice that prefer mammals such as cows and hogs. Have pincer-like claws.



NERVE-WINGED INSECTS—ORDER NEUROPTERA

(Nerve Wings)

Order Characteristics

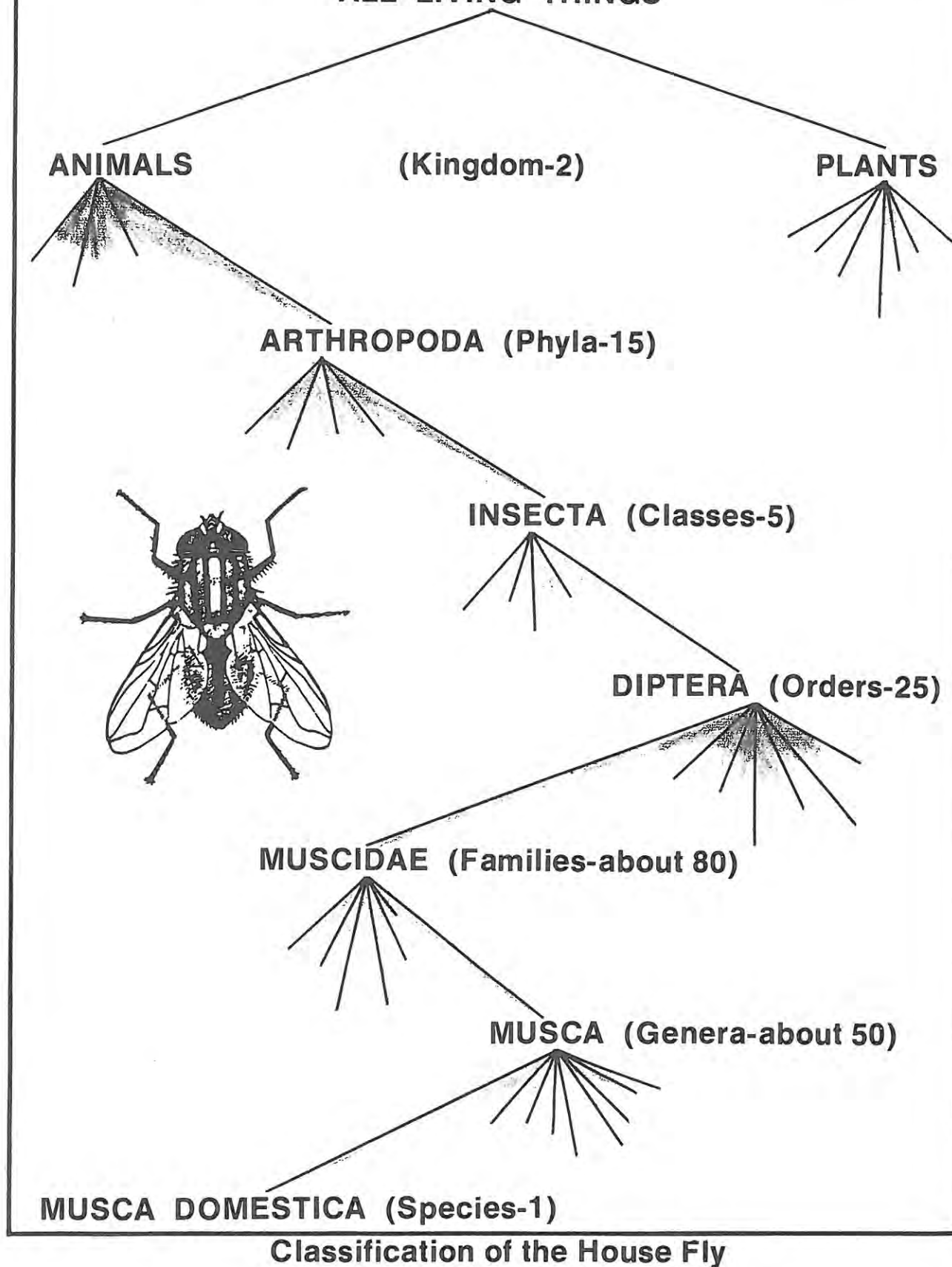
Wings—Two pairs—Large leaf-like with many fine net-like veins. Wings held roof-like when at rest.

Mouthparts—Chewing

Metamorphosis—Complete

Comments—Many of these insects are predaceous; that is, they feed on other insects.

HOW TO CLASSIFY ALL LIVING THINGS



WHERE TO LEARN MORE ABOUT INSECTS

26

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WWW sites

<http://www.ento.vt.edu>
<http://www2.ncsu.edu/cals/entomology/homepage.html>
<http://www.ces.ncsu.edu>
<http://colostate.edu/Depts/Entomology/ent.html>
<http://www.public.iastate.edu/~entomology/>

Other

Young Entomologists' Society, Inc.
 1915 Peggy Place
 Lansing, MI 48910-2553

ENTOMOLOGY I—FIRST YEAR RECORD

Name _____ Age _____

Address _____

Parents' Name _____

Date Project Started _____

Date Project Completed _____

County _____ Name of Club _____

1. Tell how to identify insects:

(a) _____

(b) _____

(c) _____

2. List the entomological equipment you have:

(a) _____

(b) _____

(c) _____

(d) _____

3. What talks on insects or exhibits have you participated in?

(a) _____

(b) _____

(c) _____

4. Write a brief story of your entomological experiences.

I have checked this record and found it to be satisfactorily completed. I have read the story.

Signature of Leader and/or Extension Agent.

ENTOMOLOGY I—SECOND YEAR RECORD

Name _____ Age _____

Address _____

Parents' Name _____

Date Project Started _____

Date Project Completed _____

County _____ Name of Club _____

1. Name the different types of Metamorphosis and the insect stages found in each:

(a) _____

(b) _____

(c) _____

(d) _____

2. What entomological equipment have you added this year?

(a) _____

(b) _____

(c) _____

3. List the talks given, demonstrations, and exhibits you were involved in and any newspaper articles you prepared.

(a) _____

(b) _____

(c) _____

4. Write a brief story of your entomological experiences.

I have checked this record and found it to be satisfactorily completed. I have read the story.

Signature of Leader and/or Extension Agent.

ENTOMOLOGY I—THIRD YEAR RECORD

Name _____ Age _____

Address _____

Parents' Name _____

Date Project Started _____

Date Project Completed _____

County _____ Name of Club _____

1. List 5 Orders and tell what stage(s) of the insect causes damage to plants or animals:

(a) _____

(b) _____

(c) _____

(d) _____

(e) _____

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2. Did you make or obtain any new equipment this year? Please list:

(a) _____

(b) _____

(c) _____

3. List 10 harmful insects and 5 beneficial insects that you have read about:

Harmful Insects

(a) _____ (f) _____

(b) _____ (g) _____

(c) _____ (h) _____

(d) _____ (i) _____

(e) _____ (j) _____

Beneficial Insects

(a) _____ (d) _____

(b) _____ (e) _____

(c) _____

4. Write a brief story of your entomological experiences.

I have checked this record and found it to be satisfactorily completed. I have read the story.

Signature of Leader and/or Extension Agent.

INSECT COLLECTION LABELS

Fill in label and place it on the pin just below the insect. Print the name of the nearest town on the first line, print the month, day and year on the second line and print the name of the collector of the insect on the third line.

[illegible]



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