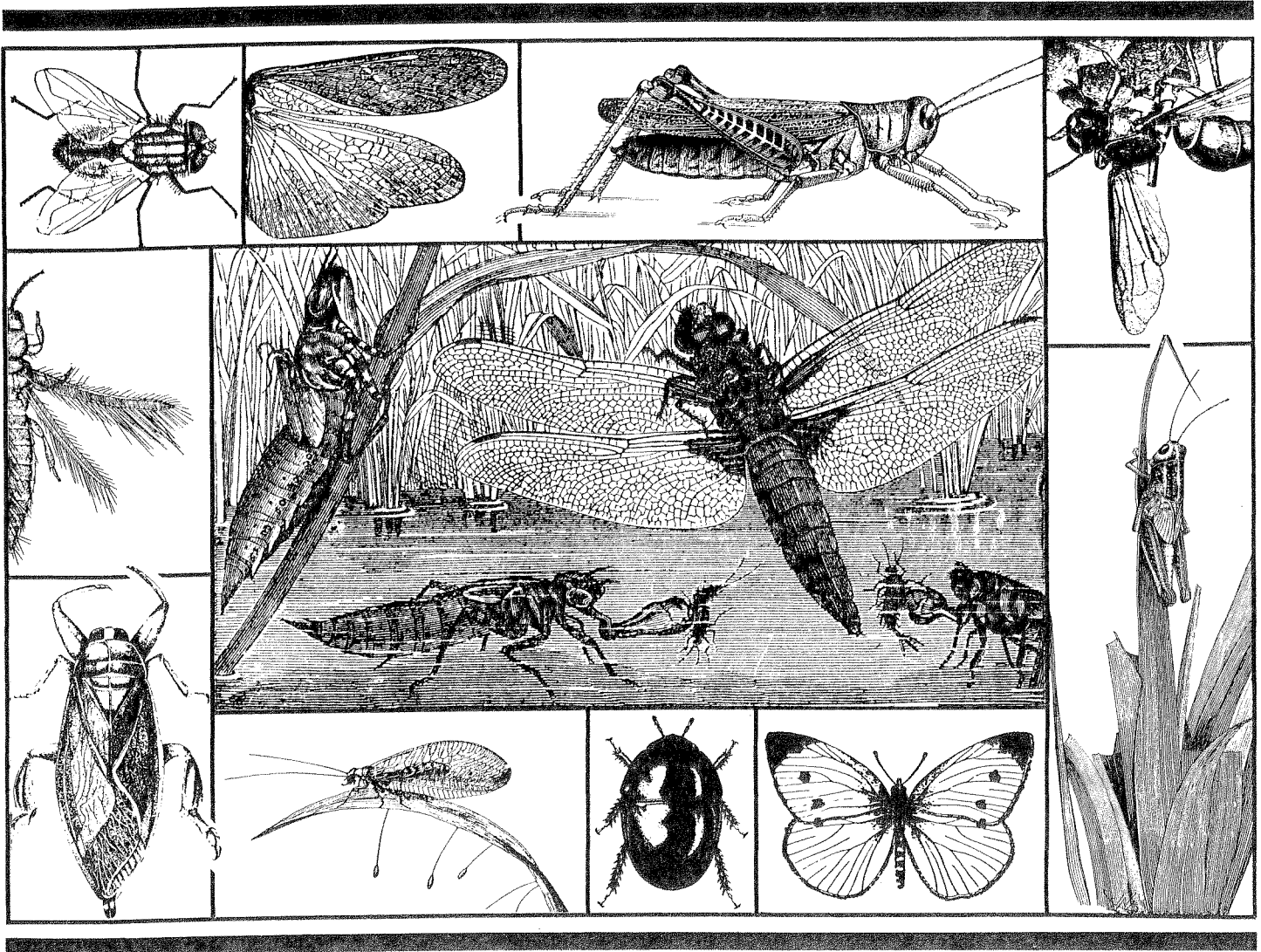


A Key to INSECT ORDERS

Prepared by R. A. Scheibner



IDENTIFYING COMMON INSECT ORDERS

Part of your Kentucky 4-H entomology project involves collecting, identifying and labeling insects for your collection. This book will help you as you identify the insects that you collect. It can also help you learn about insect orders you have not yet collected.

When you look at different breeds of cats and dogs you somehow know which animals are cats and which are dogs. Even if you have never seen some of the breeds before, you most likely have no trouble deciding whether the animal is a cat or a dog. However, you may have to think a while to explain how you are able to make the distinctions. Some cats may be as large as small dogs, be the same color, have the same length of hair and be with or without long tails. You may have to look long and hard for characteristics that will reliably separate cats from dogs.

Separating insects into logical groups is even more of a problem because most of us are not familiar enough with insects to be able to separate

them on intuition. True flies (Order Diptera) can sometimes look like wasps or bees (Order Hymenoptera), and we need some reliable characteristics to distinguish between them. Part of the purpose of this booklet is to point out some of the characteristics which are reliable in sorting insects into different orders. Sometimes a characteristic we choose to separate insect orders may seem to be an inconspicuous or slight difference. However, that characteristic may be the only easily seen one that is reliable in placing the insects in their natural grouping. There are actually many typical differences between orders of insects. But there always seem to be exceptional insects that don't have all the typical characteristics of the order to which they belong. For instance, Diptera (true flies) are typified by having one pair of wings, but there are some flies that have no wings. The wingless fly, however, has the other combination of characteristics of flies so we can recognize it as a fly.

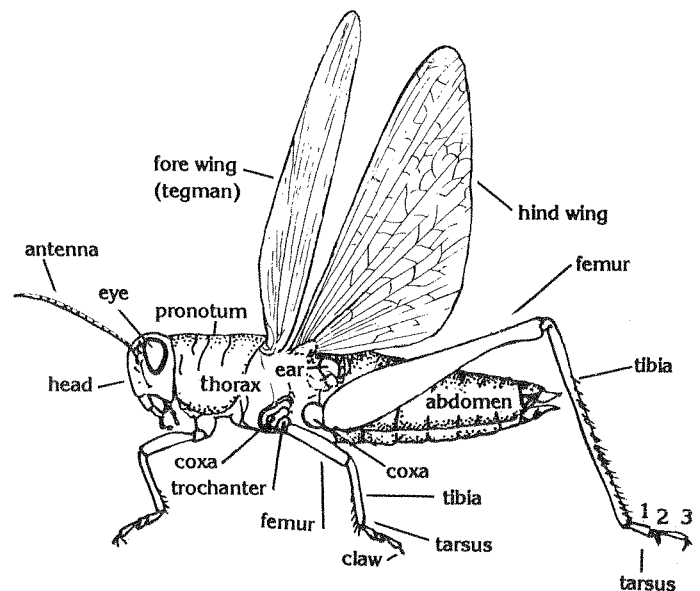
IDENTIFYING INSECTS

One way to identify an insect is to leaf through an entomology book until you find a picture of it or a picture very close to it. This may work all right if you have a common insect and there are not a lot of pictures to look at. If you have an uncommon insect and the book does not have enough pictures, you may not find a good match. Because insects sometimes mimic each other in appearance, there is also the danger of mismatching your insect with a picture of an insect belonging to an entirely different group.

Another way is to read descriptions of different insects until you find one that fits. This is very time-consuming too.

The use of a key such as this booklet is a means for avoiding some of these problems. A key makes you look at important clues in an orderly way, and it helps you get an identification more quickly. To use a key you will need to know something about the

anatomy of insects in general. In using the key, you will learn more and more about insect anatomy. Start by studying the label drawing of the grasshopper and learn the names of its parts.



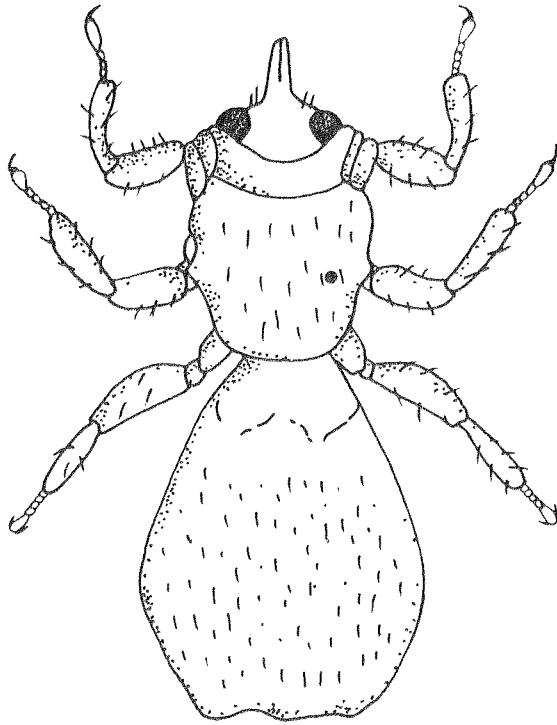
HOW TO USE AN IDENTIFICATION KEY TO INSECT ORDERS

A key is a set of paired and numbered statements or couplets. Each of the two statements in a couplet is lettered with an "a" or a "b." The lettered statements in a couplet are in contrast with each other (that is, they are different from each other). The insect you are looking at should agree with statement "a" or "b" but not with both statements. At the end of the statement that agrees with your insect is a number which tells you what couplet you should read next. Again you make a choice and proceed in this way until the name of an insect order appears at the end of the statement you choose. You can then turn to the page of that insect order to check your

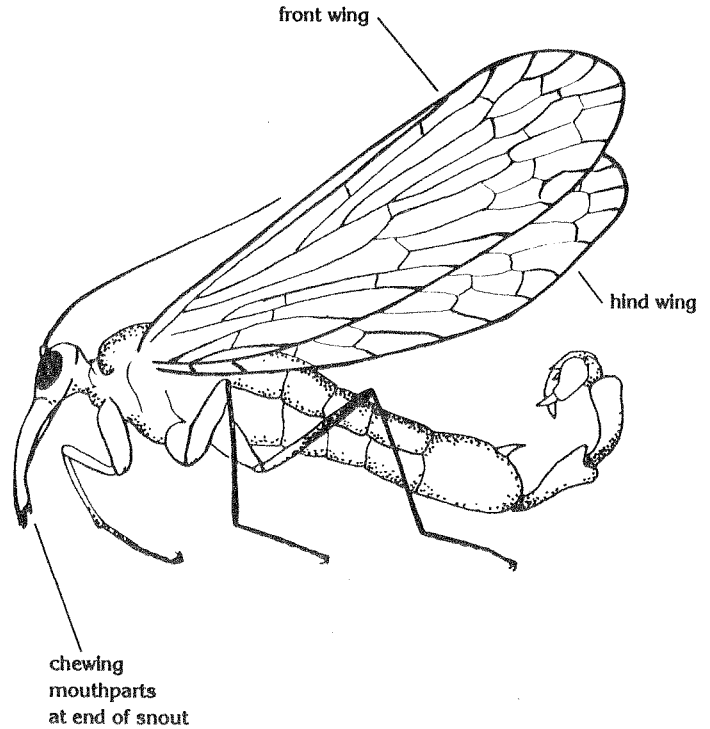
accuracy in using the key. To begin with, practice using the key with some insects for which you already know their order names.

For example, let's run a moth through the key. We read couplet 1 and agree the moth has wings, which agrees with statement 1b. At the end of statement 1b is the number 16. We then go to couplet 16, and since a moth has two pairs of wings, choose the "b" statement which leads us to 17. At 17b we are led to 21. Statement 21a is the correct choice. At the end of 21a is the name LEPIDOPTERA, the order to which moths belong.

Do you know the orders to which these insects belong? Try using the key to find out.



The correct path through the key is 1a, 2b, 3b, 4a, 5b, 6a. Check out the order on page



The correct path through the key is 1b, 16b, 17b, 21b, 22b, 23b, 24a, 25a, 27b, 28a.

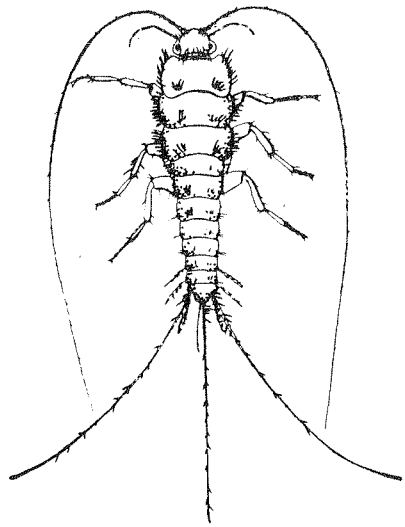
Practice using the key using insects you know in your collection. After you have confidence in using the key, see if you can key out one of your insects whose order you don't know.

Key to Order of More Common Adult Insects

1a.	Without wings, all of the abdominal segments visible in a top view of the insect	2
b.	With wings (Some insects are not obviously winged because the flying wings are covered with hard wing covers. The wing covers lie over the back and hide all or at least some of the abdomen from dorsal view.)	16
<hr/>		
2a.	Without legs, eyes or antennae; living under a waxy or cottony covering and occurring in colonies firmly attached to tree twigs, fruit or leaves (scale insects)	Order 14 HOMOPTERA
b.	Legs and antennae and, usually, the eyes present	3
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3a.	Abdomen ending in three long, thread-like tails; antennae long	Order 1 THYSANURA
b.	Abdomen without long tails; antennae may be short or long	4
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4a.	Antennae shorter than the head, not easily seen; body flattened from side to side or from top to bottom; parasites on animals	5
b.	Antennae longer than the head, easily seen; not usually parasites	8
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5a.	Body flattened from side to side; legs long and able to jump; with sucking mouthparts	Order 21 SIPHONAPTERA
b.	Body flattened from top to bottom; legs short and not able to hop	6
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6a.	Abdomen sac-like and without distinct segments; eyes clearly visible; tarsi 5-segmented; about house fly size; sheep parasites	Order 20 DIPTERA
b.	Abdominal segments distinct; eyes small or absent; tarsi 1- to 2-segmented; less than 1/8 inch long	7
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7a.	Head narrowed toward the front, the entire head narrower than the thorax; mammal parasites	Order 12 ANOPLURA
b.	Head broadly rounded in front, the entire head wider than the thorax; mostly bird parasites	Order 10 MALLOPHAGA
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8a.	Body strongly constricted between the thorax and abdomen	Order 22 HYMENOPTERA
b.	Thorax and abdomen broadly joined	9
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9a.	Body scaly; a coiled tongue sometimes visible; usually found on tree trunks	Order 19 LEPIDOPTERA
b.	Body not scaly	10
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10a.	With a sucking beak, the beak of some may seem to come from between the front legs	11
b.	Beak absent, chewing mouthparts	12
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- 11a. With 2 tube-like projections near the end of the abdomen; soft-bodied and living in colonies on plants; antennae long; beak coming from the front legs Order 14 HOMOPTERA
- b. Without tube-like projections on abdomen; beak arises from front of head Order 13 HEMIPTERA
-
- 12a. Tarsi either 5-segmented or the hind legs adapted for jumping ORTHOPTERA 3
- b. Tarsi with less than 5 segments and the hind legs not adapted for jumping 13
-
- 13a. Ant-like appearance except they are soft-bodied and cream-colored, with 4-segmented tarsi, eyeless, and antennae look like a string of round beads; the thorax and abdomen are broadly joined Order 4 ISOPTERA
- b. Not fitting the description of 13a; eyes usually well developed 14
-
- 14a. With a forked tail near the end of the body used for jumping; the spring tail may be folded under the body Order 2 COLLEMBOLA
- b. Without a forked tail 15
-
- 15a. Oval-shaped and louse-like in appearance; antennae long and thread-like Order 9 (PSOCOPTERA or CORRODENTIA)
- b. Body narrow; found on flowers and leaves Order 11 THYSANOPTERA
-
- 16a. With only one pair of wings; the hind pair reduced to small structures that look like golf tees Order 20 DIPTERA
- b. With two pairs of wings, although the first pair may be thick and hard and not function as organs of flight 17
-
- 17a. Front wings thicker in texture than the hind wings for all or part of their area 18
- b. Front and hind wings both of the same texture throughout 21
-
- 18a. Front wings horny or leathery in texture throughout and meeting in a straight line down the center of the back usually 19
- b. Front wings parchment-like or leathery throughout or on the basal half only; they do not meet in a straight line down the center of the back. In the lace-bugs the entire top of the insect looks like lace 20
-
- 19a. Front wings short leaving much of the abdomen exposed; a pair of pincher-like appendages at the end of the abdomen Order 15 DERMAPTERA
- b. Front wings usually cover all the abdomen; never with abdominal appendages Order 16 COLEOPTERA
-
- 20a. With a jointed beak; basal part of the front wing thickened and the tip membranous. Antennae with 5 or less segments Order 13 HEMIPTERA
- b. With chewing mouthparts; front wings parchment-like throughout; antennae with many segments Order 3 ORTHOPTERA

21a.	Wings with scales on all or part of their area; mouthparts in the form of a coiled tongue	Order 19 LEPIDOPTERA
b.	Wings without scales although they may have hairs	22
22a.	Wings long, narrow, veinless, all four of equal size, and fringes with long hairs; small insects about 1/10 inch long; tarsi 1- or 2-segmented	Order 11 THYSANOPTERA
b.	Not fitting the description in 22a	23
23a.	Mouthparts composed of a beak arising near the back of the head near the front legs; wings held roof-like over the body, the hind pair smaller than the front pair	Order 14 HOMOPTERA
b.	Mouthparts not in the form of a piercing beak although the front of the head may be prolonged into a snout; wings not held roof-like over the body; usually the hind pair of wings about the same size as the front pair or the abdomen with 2 or 3 long thread-like tails	24
24a.	With many cross-veins (more than 15) in each wing	25
b.	With few cross-veins or the veins indistinct	29
25a.	Antennae about as long as the head and thorax together or longer	27
b.	Antennae short and bristle-like, about as long as head alone or shorter	26
26a.	Hind wing much smaller than the front wing; abdomen ending in 2 or 3 long thread-like tails	Order 6 EPHEMEROPTERA
b.	Front and hind wing nearly equal; no abdominal tails; wings with a stigma and nodus	Order 7 ODONATA
27a.	Abdomen ending with 2 short tails	Order 8 PLECOPTERA
b.	Abdomen without tails	28
28a.	Head prolonged into a snout, the tip of the abdomen sometimes with a tail like a scorpion's	Order 17 MECOPTERA
b.	Head not prolonged into a snout	Order 5 NEUROPTERA
29a.	All four wings long, narrow, equal sized, without distinct veins; wings about twice the body length	Order 4 ISOPTERA
b.	Insects not fitting the description in 29a	30
30a.	Wings hairy; antennae thread-like and usually as long as or longer than the body; mouthparts indistinct; front and hind wings nearly equal in size	Order 18 TRICHOPTERA
b.	Wings not hairy; chewing mouthparts present; hind wings noticeably smaller than the front wings	31
31a.	Tarsi 2- or 3-segmented; small insects less than 1/8 inch long. Never constricted between the thorax and abdomen	Order 9 PSOCOPTERA (CORRODENTIA)
b.	Tarsi 4 or 5 segmented; size variable; most are constricted between the thorax and abdomen	Order 22 HYMENOPTERA



Silverfish

1. THYSANURA

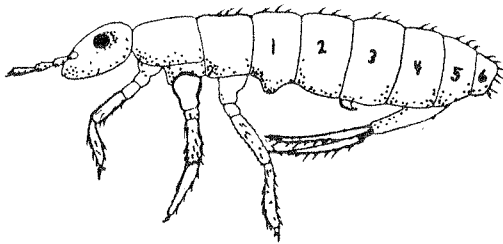
(from the Greek thysanos = tassel + oura = tail)
 (Common names: silverfish, firebrats, bristletails, slickers)

Thysanura are wingless and have chewing mouthparts, long thread-like antennae, no metamorphosis, and three long threadlike tails at the end of the abdomen. There are also tiny appendages on the underside of the abdomen, and the body may have scales on it.

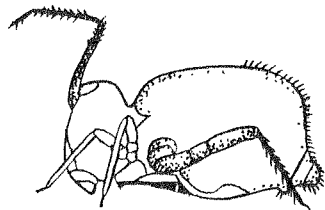
Two species, the silverfish and the firebrat, are considered pests. The firebrat prefers places that are rather warm such as around ovens in bakeries. The silverfish is the one most often found in homes where it will range over most of the house. Both species eat starchy materials such as flour, paste and so on. In bad infestations, silverfish may roughen book covers and papers on which they chew. The jumping bristletails are found out of doors under rock piles or forest litter.*

2. COLLEMBOLA

(from the Greek colla = glue + embolon = wedge or peg)
 (Common names: springtails, snowfleas)



Springtail



Springtail

Collembola are tiny and wingless, have chewing mouthparts and no metamorphosis. The antennae are usually conspicuous. The scientific name comes from the fact that on the first abdominal segment there is a short tube (collophore) by which they can stick to smooth surfaces. The common name, springtail, refers to the springing structure (furcula) near the tip of their tiny body. Some Collembola can spring several inches, and because of their tiny size seem to disappear before your eyes when they jump. One species is dark colored, and on warm winter days large numbers of them will come out of hibernation to bask in the sun on the surface of the snow. These are the snowfleas.

None of the Collembola are of much economic importance although they are plentiful and can be found in many kinds of habitats. They can often be found in large numbers under loose bark of logs or under stones and damp litter. Some species occur on the quiet water surface along the edges of ponds and streams. They are so small that they do not break through the surface film of the water.

* In recent studies it was concluded that jumping bristletails are a separate order, Microcoryphia. The name derives from the Greek words micro=small and koryphe=head.

3. ORTHOPTERA

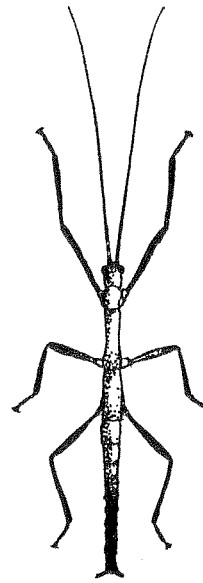
(from the Greek *orthos* = straight + *ptera* = wings)

(Common names: grasshoppers, locusts, katydids, crickets, mole crickets, mantids, cockroaches, walking-sticks)

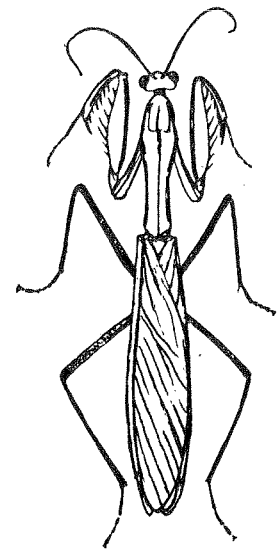
Orthoptera are medium- to large-sized insects with gradual metamorphosis, and with no wings or one or two pairs. When there are two pairs of wings, the front ones are usually leathery or parchment-like in texture. The hind wings are membranous and folded fanwise underneath. The front pair of wings of grasshoppers (tegmina) are straight and narrow, which is the basis for the scientific name of this order. The antennae of Orthoptera are long and, in some, very long.

In some books and keys, this order is divided into several more orders or suborders. Orthoptera or Saltatoria contains only the jumping species; Blattaria, the roaches; Mantoidea, the mantids; and Phasmida, the walking-sticks. In other books the cockroaches and mantids may be placed together in a group called Dictyoptera.

Many of the representatives of this order are of economic importance. Grasshoppers or locusts are pests because they destroy millions of dollars worth of cereal crops; tree crickets injure tree twigs by laying eggs in them; walking-sticks can strip an oak forest of all its leaves; roaches and crickets are household pests; and mantids are economically beneficial in destroying other insect pests.



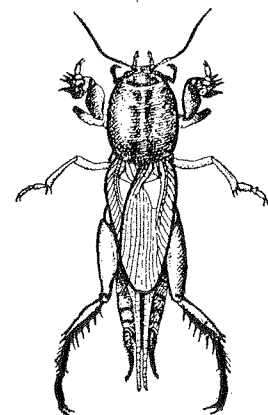
Walkingstick



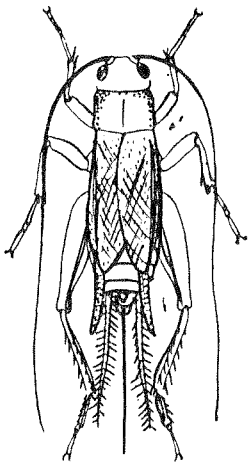
Praying mantid



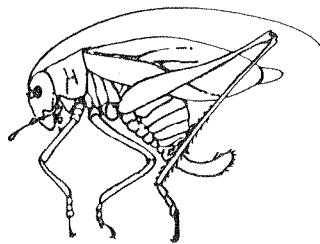
Mole-Cricket



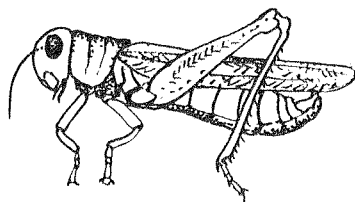
Tree Cricket



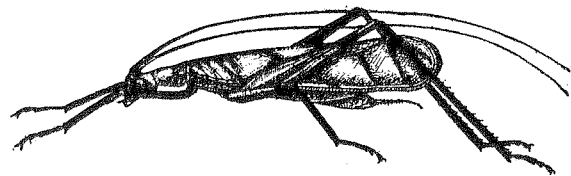
Cricket



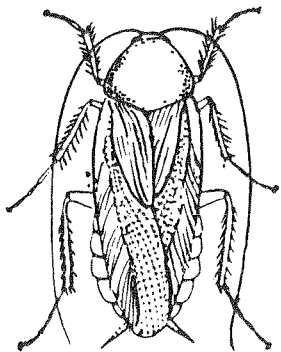
Katydid



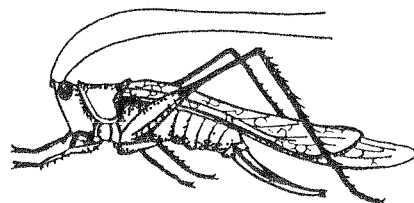
Grasshopper



Tree Cricket



Cockroach

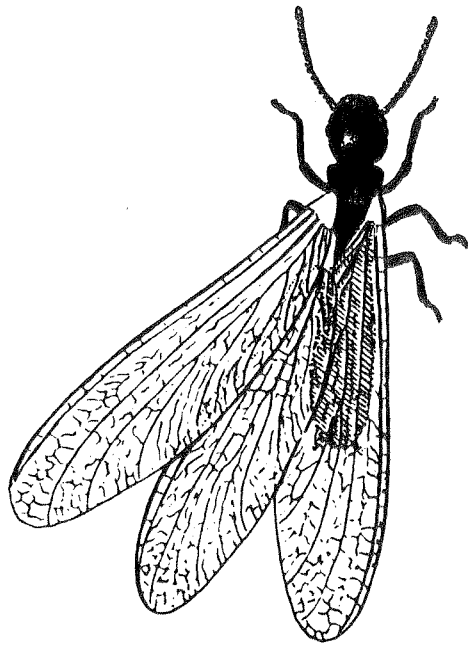


Meadow Longhorn Grasshopper

4. ISOPTERA

(from the Greek isos = equal + ptera = wings)

(Common names: termites, white-ants)



Termite;
Swarmer

Termites are small soft-bodied, social insects with chewing mouthparts and antennae composed of a series of round segments. They develop by gradual metamorphosis. There are many species of termites, but only one species, the eastern subterranean termite, is common in Kentucky. They nest in underground colonies and stay out of sight except for the kings and queens, which are active during the swarming season. The colony is made up of castes including mostly workers, some soldiers, and a queen. Secondary queens may also be present. The termites feed on wood that is in or near the soil. They often build hollow, mud-like, shelter tubes up from the ground to reach wood not in contact with the soil. The shelter tubes protect the termites from being exposed to light, dry air and their enemies.

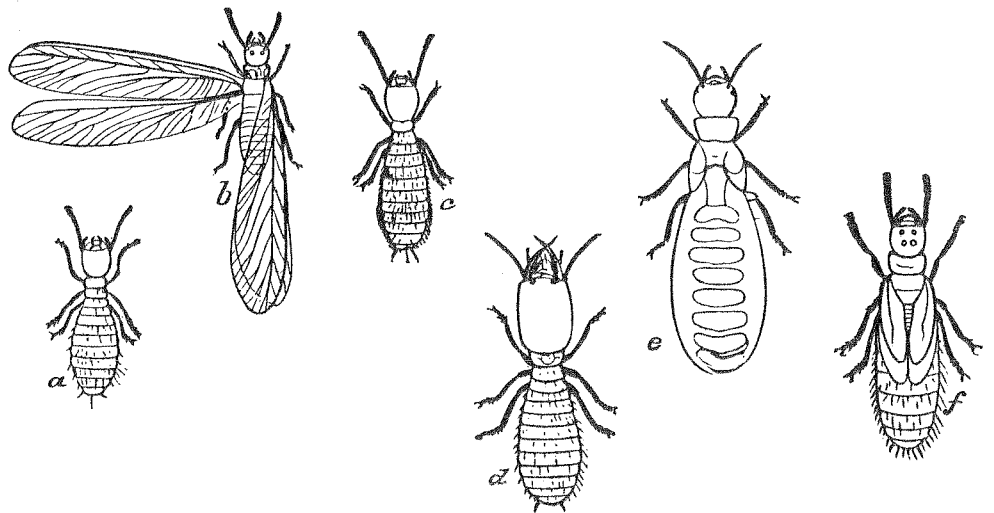
When termites digest old stumps and woody forest litter they do a useful service. When they attack the wood of our homes and other structures, they are a serious pest. Millions of dollars are spent each year in Kentucky to protect homes from termite attack. Ants that nest or swarm around homes are often confused with termites. Ants can be distinguished from termites by making the following comparisons:

Termites

1. Abdomen broadly jointed to the thorax
2. Antennal segments round and all of equal size
3. Workers and soldiers without eyes
4. Wings of swarmer twice the length of the body
5. All wings the same length

Ants

1. Abdomen narrowly jointed to the thorax
2. First antennal segment about as long as the rest combined
3. Workers and soldiers almost always with eyes
4. Wings of swarmer less than twice the body length
5. Hind wings shorter than front wings



Termite: a. Worker, b. Male;
c, e, f, stages of female; d, soldier.

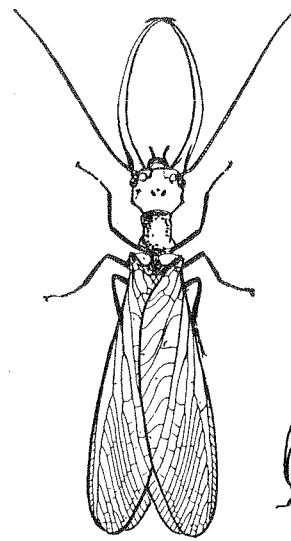
5. NEUROPTERA

(from the Greek *neura* = nerves + *ptera* = wings)

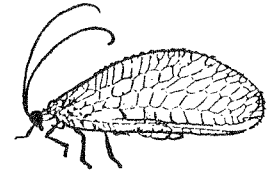
(Common names: *nervewinged insects*, *lacewings*, *alderflies*, *dobsonflies*, *snakeflies*, *antlions* and others)

These insects have two pairs of membranous wings with many cross-veins, chewing mouthparts, and long antennae. Metamorphosis is complete. Most members of this order are small- to medium-sized and delicate. The dobsonfly is larger, ranging from 1 1/2 to 3 1/2 inches long. Members of this order are parasitic or predaceous on other invertebrates. The shapes of the different families are variable. That of the antlion resembles the shape of a damselfly and is sometimes confused with it. Owlflies resemble antlions but have longer antennae with a shorter body. The mantispids resemble miniature mantids. The green lacewing is a common representative of this order and is a beneficial insect in all of its life stages because it destroys aphids. The larva of the green lacewing is commonly called the aphision.

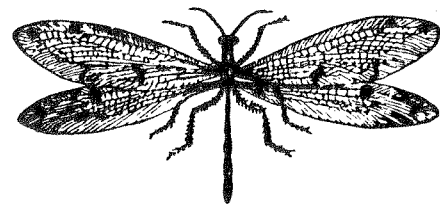
The order Neuroptera once included several other orders such as Mecoptera, Plecoptera, Isoptera, Psocoptera, and Trichoptera. In many present day references the order Neuroptera, as it is considered here, is divided into several more orders. Alderflies and dobsonflies are considered a separate order—Megaloptera—and snakeflies are put in the order Raphidioidea. Snakeflies do not occur in Kentucky.



Dobsonfly



Lacewing



Antlion

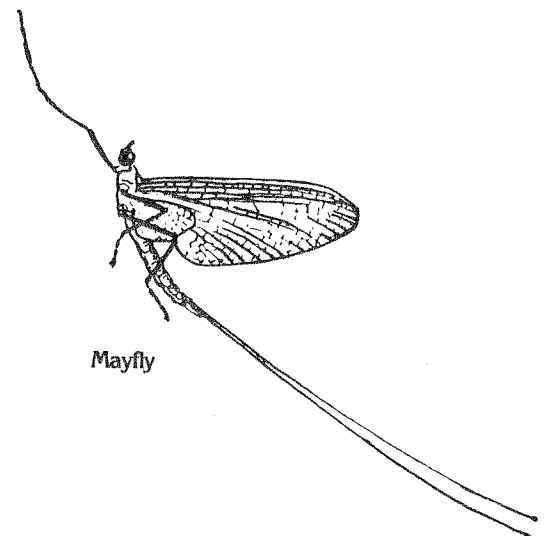
6. EPHEMEROPTERA

(from the Greek *ephemerus* = living but a day)

(Common names: *mayflies*, *dayflies*, *bayflies*)

Mayflies are small- to medium-sized, weak fliers, soft-bodied and have an incomplete metamorphosis. The small species may have one pair of wings, but the medium size have two pairs of wings, undeveloped chewing mouthparts, two or three long thread-like abdominal tails and short bristle-like antennae. The wings are membranous, with many cross-veins, and the hind pair is much smaller than the front pair. All the immature forms are aquatic. There is a peculiarity among mayflies in that there is one more molt of the fully winged insect. The winged mayfly that emerges from the naiad (aquatic nymph) has dusky wings and is called a "dun." After a brief period, the subimago (or dun) molts to produce the imago (spinner) which is the clear-winged form of the insect. Mayfly adults live only a short time. Some live only a few hours, some a day or so, but some may live a week. The development of the naiad takes from one to three years.

In the Midwest, especially around the Great Lakes, these insects emerge in great hordes and are a great nuisance. They may cover the sides of buildings, sidewalks and streets to the extent that walking and driving is difficult. They have been reported so thick on railroad tracks that the locomotive's wheels slip. In other parts of the world these insects have piled up four inches deep in the general area of their emergence. Despite the nuisance they cause for the few days during emergences, mayflies are valuable as food for many fishes. The immature forms are often sold in fish bait stores as "wigglers."



Mayfly

7. ODONATA

(from the Greek *odontos* = tooth)

(Common names: *dragonflies*, *damselflies*, *Devil's darning needles*, *snake doctors*, *mosquito hawks*)

Odonata are medium- to large-sized insects with two pairs of membranous wings, bristle-like antennae and chewing mouthparts. The front and hind wings are of equal length, with many cross-veins, a notch (nodus) near the middle of the leading edge and a colored spot (stigma) near the tip. The abdomen is long and narrow. In some dragonflies, the abdomen tapers to a point like a long fang, or tooth, which suggested the scientific name for the order.

There are two main groups of Odonata: the damselflies (Zygoptera) and the dragonflies (Anisoptera). Damselflies are weak fliers along the banks of streams and ponds. Their wings are narrow at the bases. Dragonflies are strong fliers and often range long distances from water. They can hover and quickly change direction when in full flight. Although they may be common, they are one of the hardest insects to capture in an insect net.

Because Odonata, in both the adult and immature stages, are predaceous on other insects, they are considered beneficial. At times in the south, dragonflies are pests when they capture honey bees around queen-rearing operations.

8. PLECOPTERA

(from the Greek *plekos* = plaited + *ptera* = wings)

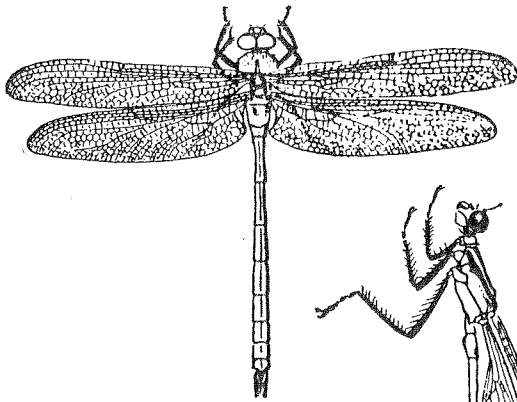
(Common names: *stoneflies*, *salmonflies*, *perlids*)

Stoneflies are small- to medium-sized insects with two pairs of membranous wings held flat over the back when not in use. The front wings are long and narrow, and the hind wings are enlarged and folded fanwise like grasshopper wings. Both wing pairs have many cross-veins. They have chewing mouthparts and long antennae. The abdomen ends in two short, thread-like tails.

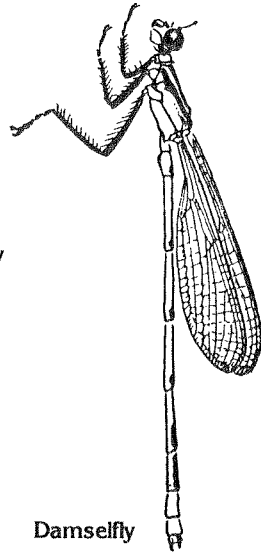
Metamorphosis is incomplete, and the aquatic nymphs (naiads) live under rocks in fast-flowing streams. The adults usually do not range far from water. The scientific name refers to how the hind wings are folded, or how the fore wings fold over the sides of the body in some species.

Plecoptera are not of much economic importance, except as a source of food for fishes. The naiads are sometimes collected and sold as fish bait, but they are hard to keep alive except in well aerated water.

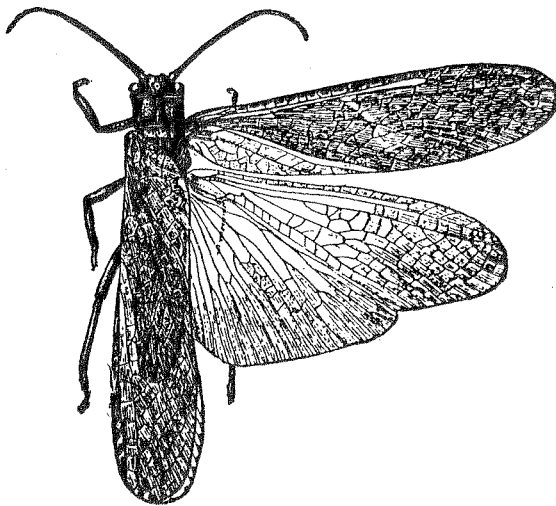
Some species, called winter stoneflies, are among the first winged insects to appear in the year. They can be found clinging to bridges in late winter or very early spring. They are black or brown.



Dragonfly



Damselfly



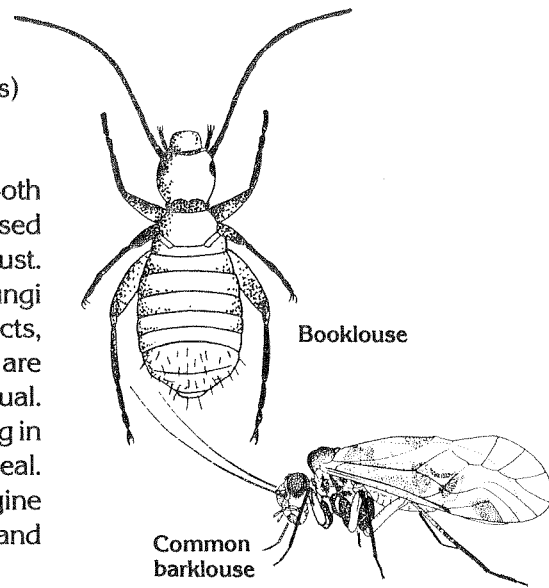
Stonefly

9. PSOCOPTERA

(from the Greek *psucho* = to rub small or fine + *ptera* = wings)

(Common names: *psocids*, *booklice*, *barklice*, *dustlice*)

This order of insects has also been called Corrodentia. Both order names, Psocoptera and Corrodentia, refer to the supposed characteristic of these insects to gnaw or grind material to dust. However, psocids are primarily scavengers or feeders on microfungi that grow on musty materials. They are small or tiny, delicate insects, with long thread-like antennae, chewing mouthparts, and are wingless or with two pairs of wings. Metamorphosis is gradual. Booklice are common wingless insects in homes, often occurring in large numbers around musty books or in humid flour or meal. Because of their resemblance to true lice, some people may imagine being painfully attacked by them. Barklice are usually winged and can be found scurrying about on tree bark.



Booklouse

Common barklouse

10. MALLOPHAGA

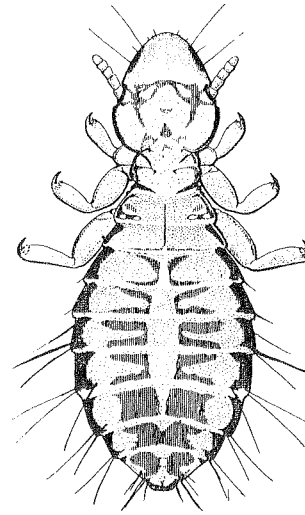
(from the Greek *mallos* = wool + *phagein* = to eat)

(Common names: *bird lice*, *chewing lice*, *biting lice*)

Chewing lice are small, flattened, soft-bodied wingless insects that are external parasites on birds and a few mammals. Mallophaga that infest mammals have two tarsal claws, and those that infest birds have one tarsal claw. They have chewing mouthparts and feed on the hair or feathers and skin scales of their host. Although chewing lice can cause much irritation, they do not spread disease organisms as do the Aoplura, or sucking lice. The antennae of Mallophaga are short, and the eyes are absent or poorly developed. Most lice are host specific; that is, each louse species will live on only one kind of host. Lice need the body warmth of their host to survive, so they do not live very long away from their host.

The metamorphosis of Mallophaga is gradual, but there is very little difference in form between nymphs and adults except for size. Many books put them in the "no-metamorphosis" group. The entire life cycle is spent on the host animal. The eggs are glued to the host's hair or feathers and are called nits.

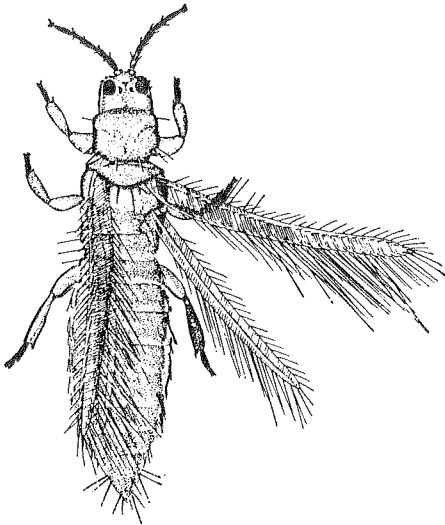
The mouthparts of chewing lice and of sucking lice are hard to see without a good microscope, but these two kinds of lice can be told apart by other characteristics. A chewing louse's head is wider than the thorax and bluntly rounded in front. A sucking louse's head is more pointed in front and is narrower than the thorax.



Chewing louse; found on the heads of poultry.

11. THYSANOPTERA

(from the Greek *thysanos* = fringe + *ptera* = wings)
(Common names: *thrips*, *thysanopterans*)



Flower thrips

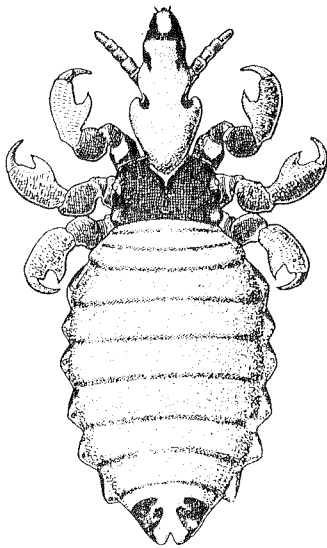
All the members of this order in this country are tiny, narrow insects with short but easily seen antennae. They are either wingless or with two pairs of long narrow wings fringed with long hairs. When at rest, the wings are held flat over the back. They are poor fliers and their flights sometimes resemble flea hops. Their mouthparts are not fully developed, and they feed by rasping leaf surfaces and sucking up the sap that flows from the wound.

Some thrips are important plant pests by causing leaf wilt or causing flower buds to drop or open unevenly. Flower petals may be streaked or browned by thrips damage. Some also spread plant viruses. A few are beneficial as predators on other tiny insects, and some feed on fungal spores.

Some of the important species are the tobacco thrips, grass thrips, onion thrips, flower thrips, gladiolus thrips and greenhouse thrips.

12. ANOPLURA

(from the Greek *anoplos* = unarmed + *oura* = tail)
(Common names: *true lice*, *sucking lice*, *cooties*, *crab lice*)



Horse louse

Sucking lice are tiny, flat, wingless, external parasites of mammals only, including humans. Although they have sucking mouthparts, this characteristic is hard to see because the mouthparts are retracted into the head when it is not feeding. More easily observable characteristics to tell Anoplura from Mallophaga, which also occur on mammals, are the head shape and the tarsi. The Anoplura head is somewhat pointed in front and narrower than the thorax. They have only one large tarsal claw which can close against a spur on the tibia to give a vise-like grip on hairs. Metamorphosis is gradual.

Sucking lice are usually host specific like chewing lice. During calamities such as wars, earthquakes, and so on, people are forced to live in close contact under unsanitary conditions. Under these conditions lice can easily spread from one person to another. At a time like this, relapsing fever, trench fever and typhus fever, which are spread by sucking lice, may also increase to epidemic proportions. Once in a while an outbreak of lice will occur under normal conditions among school children. With the use of modern insecticides, louse epidemics are more easily brought under control, but it takes a community effort.

There are several types of sucking lice that attack humans. The head louse and body louse differ only slightly from each other and are subspecies of the same louse. The crab louse is a distinct species. People who work around swine may be temporarily attacked by the hog louse. The hog louse is about 1/5 inch long and is the largest of all the sucking lice.

Species of sucking lice are common on cattle in winter. They also occur on horses, dogs and rabbits, but not as commonly.

13. HEMIPTERA

(from the Greek hemi = half + ptera = wings)

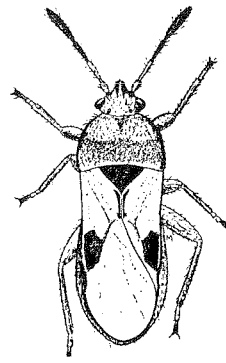
(Common name: true bugs)

Although many kinds of insects and their relatives are called "bugs," the true bugs all belong to the order Hemiptera. In the common name of an insect that is a true bug, "bug" is written as a separate word, such as plant bug, bed bug, squash bug. The name sowbug is a connected word because sowbugs are not true bugs but are really Crustaceans. Mealybugs belong in the insect order Homoptera, so mealybug is written as one word.

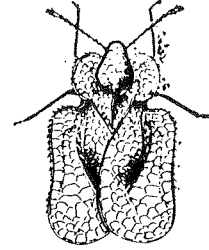
True bugs are a diverse group of insects, but they all have sucking mouthparts and gradual metamorphosis. They typically have two pairs of wings. The front pair is leathery at the base and membranous and overlapping each other at the end. It is this characteristic that suggested the scientific name for the order. When at rest, the wings lie flat on the back. Some true bugs are wingless or are short-winged or have atypical front wings. The front wings of lace bugs are lace-like and do not conform to the general description of true bug wings.

The true bugs have been grouped with other insect groups from time to time. In the most recent arrangement, the order Hemiptera includes both the homopterans and the true bugs. In this arrangement the true bugs are a suborder called Heteroptera. The Hemiptera (Heteroptera), or true bugs, have jointed beaks that arise from the front of the head. The homopteran beak arises farther back on the head and sometimes seems to come from between the front legs. The wings of true bugs are held flat over the back. Those of homopterans are most often held roof-like over the back.

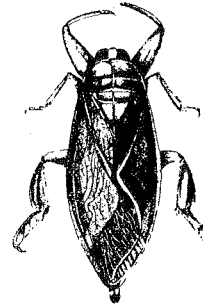
Many true bugs are important as plant pests, and a few are blood-sucking pests of animals, including humans. Some bugs are beneficial as predators on other insects. Aquatic bugs are food for fishes, but the giant water bug may feed on minnows and other small fish.



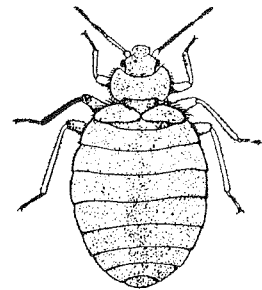
Chinch bug



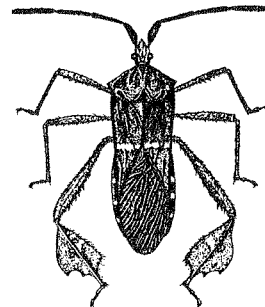
Lace bug



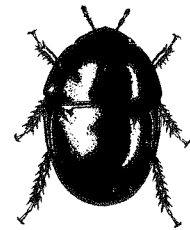
Giant water bug



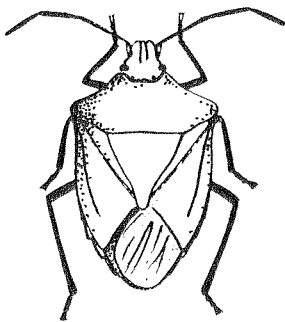
Bed bug



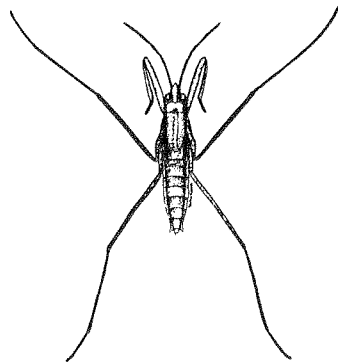
Leaf footed bug



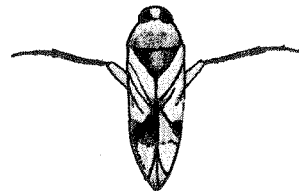
Negro bug



Stink bug



Water strider

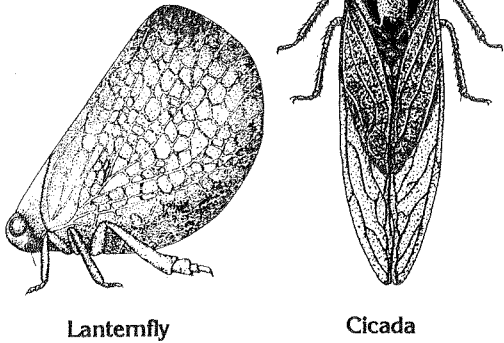


Backswimmer

14. HOMOPTERA

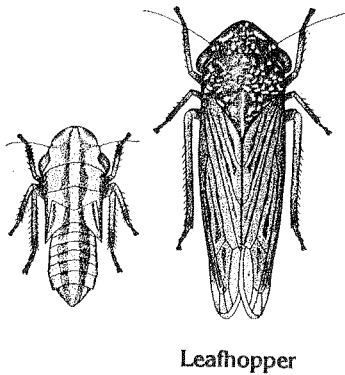
(from the Greek homos = same + ptera = wings)

(Common names: aphids, scales, leafhoppers, treehoppers, cicadas and others)

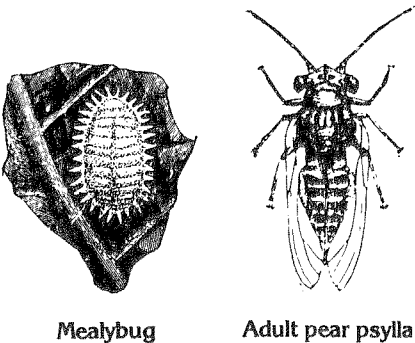


Lanternfly

Cicada



Leafhopper



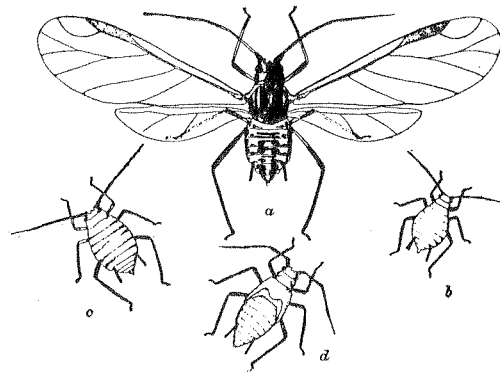
Mealybug

Adult pear psylla

There is no common name for Homoptera that includes all members of the order. The common names used when talking about this order usually apply to families within the order. Because of the different habits and appearances of insects in this order, it is hard to invent a name that would be descriptive of them. They are close relatives of Hemiptera and are sometimes included as a single order with this order. Characteristics they have in common with Hemiptera are a piercing beak and gradual metamorphosis. The beak on Homoptera, however, is farther back on the head and, in some, seems to come from between the front legs. The wings, when present, do not have the basal part of the front wing thicker than the ends. The wings are usually held roof-like over the back instead of flat on the back as among Hemiptera. They are all plant feeders.

The largest members of this order are the cicadas which make a singing sound high in trees like a buzz saw on warm, sunny summer days. The 17-year cicada has the longest life-cycle of any insect, spending 17 years under ground feeding on the roots of trees. Adults damage twigs when they lay eggs in them. In certain years cicadas are much more numerous than other years. Birds, squirrels, and even dogs eat them in great numbers.

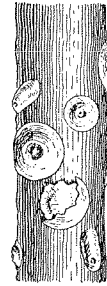
Aphids or plant lice belong in this order too and are much easier to find. They are soft-bodied, with two short tubes projecting from near the end of the abdomen. They are mostly wingless and live in colonies on plants. Large aphid colonies sap the strength of plants, and they spread viruses when they migrate to other plants. They also emit a sticky, sweet material called "honeydew" on which sooty mold may develop. For these reasons, aphids are important plant pests.



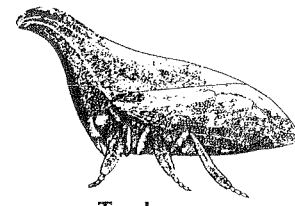
An aphid: a, winged adult aphid; b, young nymph; c, older nymph; d, last stage of nymph, or pupa

Scale insects are important plant pests too, and do not look like insects at all. They appear to be tiny motionless galls or normal encrustations on leaves and stems. Armored scales are those that produce a hard, waxy detachable shell under which the soft-bodied insect lives. Common scale shell shapes are round, oval, oblong and oyster shell-shaped. Soft scales do not produce a detachable shell, but their skin may be as tough as the shell of armored scales. There are also other types of scale insects besides armored scales and soft scales.

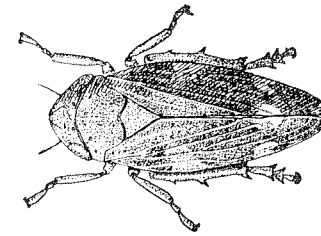
Other common members of the Homoptera include treehoppers, planthoppers, leafhoppers and spittlebugs. Some of these groups resemble each other in general appearance. Treehoppers differ from the others by having the pronotum project backward over the abdomen. On planthoppers, the antennae are on the side of the head below the eyes. Spittlebugs have one or two stout spines on the hind tibia. Leafhoppers have one or more rows of fine spines along the hind tibia, which helps separate these two types of similar-looking insects.



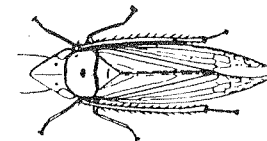
Scale insects



Treehopper



Spittlebug



Leafhopper

15. DERMAPTERA

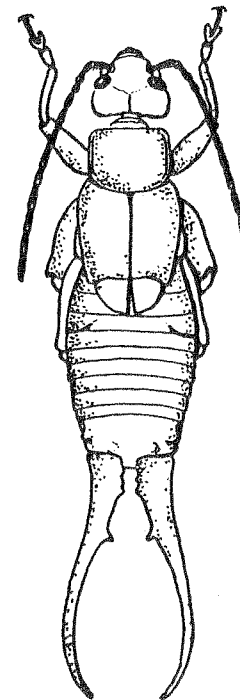
(from the Greek derma = skin + ptera = wings)

(Common name: earwigs)

Dermaptera have a gradual metamorphosis, chewing mouthparts, and the abdomen ends with a pair of pincers. The front wings (tegmina), when present, are short. They are like tough skin as are the bases of the hind wings. In fact, this is the basis for the scientific name for this order. The hind wings are folded lengthwise and crosswise under the front wings, though some species are wingless. The common name, earwig, may have come from the old superstition that this insect entered the ears of sleeping persons. Or it may have been that the pincers resemble those used to pierce ears for earrings or that the expanded hindwing resembles the shape of a human ear. The latter association may have given rise to the name "ear-wing" which degenerated into "earwig."

The female earwig lays her eggs in a slight depression under rocks or logs and guards them until they hatch. She continues her guard of the nymphs for a short time, and then the nymphs are on their own.

Earwigs are not abundant in this area. They are nocturnal in habit so they don't appear in many 4-H collections. Occasionally one is caught by sweeping with a net or when they are attracted to lights. Sometimes rove beetles are mistaken for earwigs and are put in 4-H collections as earwigs. In some areas they are common pests on plants or nuisances in homes.

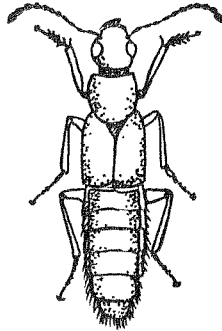


Earwig

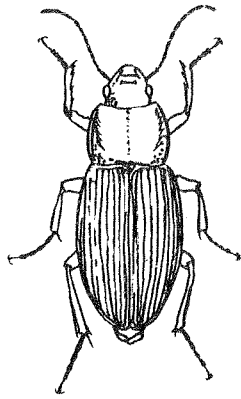
16. COLEOPTERA

(from the Greek *coleos* = sheath + *ptera* = wings)

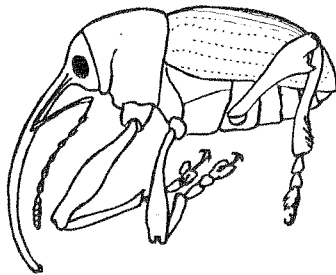
(Common names: *beetles, weevils, curculio, chafers*)



Rove beetle



Ground beetle



Weevil

The name Coleoptera for the beetles is descriptive of the front wings (elytra) which form a covering or sheath over the hind wings. Usually the elytra are hard. They meet each other in a straight line down the center of the back and extend to the tip of the abdomen. However, there are exceptions. The elytra of some, such as rove beetles, are short and expose much of the abdomen in a top view. Some beetles, such as lightning beetles, soldier beetles and blister beetles, have elytra that are not as hard and brittle as those of most other beetles. Most beetles can fly, but the flying wings are hidden under the elytra when the beetles are at rest.

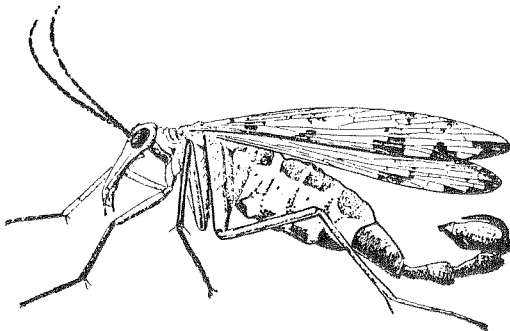
All beetles have chewing mouthparts, but the jaws of weevils are at the end of a stout. The snout is sometimes long and thin and resembles a sucking beak. The antennae of beetles may be long or short and of many different shapes. The metamorphosis of beetles is complete, and the larvae of some have special common names, such as white grubs and wireworms.

Coleoptera contains the most number of species of any of the insect orders. They are separated into more than 100 families. Many of the families have distinctive shapes or characteristics which separate them easily from other beetle families. Sometimes families may resemble one another very closely. These can be separated only on the basis of microscopic details. Some beetle families are very variable in general appearance, such as the leaf beetle family. The leaf beetle family includes such common beetles as the Colorado potato beetle, flea beetles, tortoise beetles and asparagus beetles, which are very different in size and shape. Pictures will help you accurately identify many of the beetles, but once in a while you may be fooled.

17. MECOPTERA

(from the Greek *mecos* = long + *ptera* = wings)

(Common names: *scorpion flies, hangflies*)



Scorpionfly

These are medium-sized, delicate insects, with complete metamorphosis, two pairs of wings which are long and with many cross-veins, long antennae, and chewing mouthparts at the end of a long stout. The end of the abdomen of male scorpionflies ends in a tail like that of a scorpion. Hangflies resemble crane flies in appearance and are often confused with them in beginning collections. Hangflies have two pairs of wings, however, and crane flies have but one pair. Hangflies get their common name from the way they rest on leaves or twigs. Both kinds of Mecoptera are found lurking around low shrubbery at the edge of woods where they feed on mosquitoes and other small insects.

18. TRICHOPTERA

(from the Greek trichos = hair + ptera = wings)
(Common names: caddisflies, caseflies, watermoths)

Trichoptera have a complete metamorphosis, the immature stages of which all occur in water. The larvae of many species construct cases around themselves with saliva and bits of twigs, reeds, or sand. This gives them their common name—caseflies. Some construct webbed nets but no case. The adults resemble certain moths but have hairy instead of scaly wings, which is the basis for the scientific name.

Trichoptera are closely related to Lepidoptera but differ from them in having chewing mouthparts. The antennae are long and thread-like. The wings are slightly hairy instead of scaly. In side view they often have a triangular outline. The larvae differ from Lepidoptera larvae also in that they never have abdominal legs with crochets (groups of hooked spines at the end of abdominal legs). Also, they differ in that the larvae all live in water.

Trichoptera are the largest single group of aquatic insects and are important sources of food for fishes. The adults fly mostly at night but are attracted to lights. Their sizes range from small to medium size.



Caddisfly



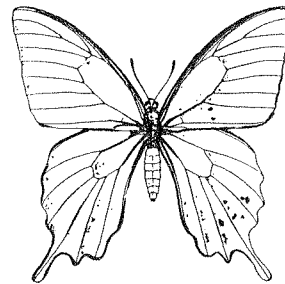
Caddisfly

19. LEPIDOPTERA

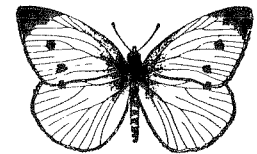
(from the Greek lepidos = scale + ptera = wings)
(Common names: moths, butterflies, skippers)

Everyone is familiar with the showy and beautiful butterflies and some moths, but not everyone can distinguish moths from butterflies from skippers. They all have coiled sucking mouthparts, scales on their wings and a complete metamorphosis. The main difference in these three groups of Lepidoptera is in the form of the antennae. Butterflies have thread-like antennae that are thickened at the end. Skippers have thread-like antennae, but there is a thickening just before the end, and the end often is bent back to form a sort of hook. Moth antennae may be thread-like for their entire length, feathery or spindle shaped. Most moths fly at night, while butterflies and skippers are day fliers. Most moth caterpillars spin a cocoon in which to pupate, but butterflies never spin a cocoon. A few moths are wingless.

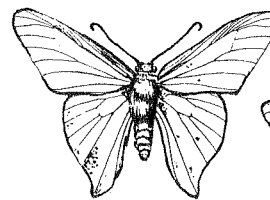
Caterpillars of many moths and a few butterflies and skippers are important pests of plants. Most caterpillars eat plant leaves, but the caterpillars of some moths also eat woolen materials, stored food and grain. Or they may bore in plants—including trees. A few kinds of caterpillars are adapted for living in water. Some caterpillars have poisonous spines on their body, and if they are handled carelessly can produce a sting as bad as a wasp sting.



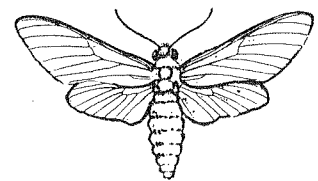
Butterfly



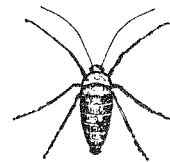
Cabbage butterfly



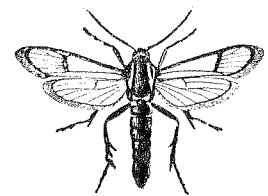
Skipper



Moth



Canker worm moth
(female)

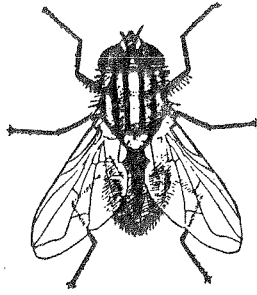


Clearwing moth

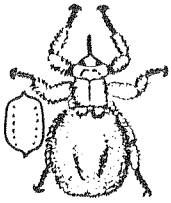
20. DIPTERA

(from the Greek di = two + ptera = wings)

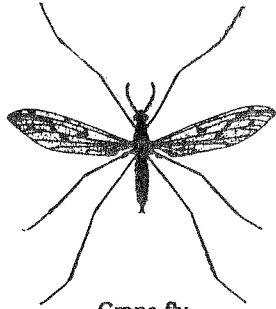
(Common names: true flies, gnats, midges, mosquitoes)



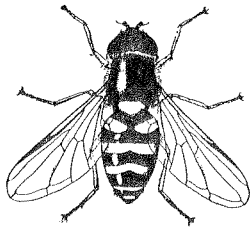
House fly



Sheep ked



Crane fly



Syrphid fly

Some members of other insect orders may have only two wings, but only the Diptera are typical with two wings. A few flies, such as the sheep ked are wingless. Where the second wings should be, there is a small structure called a haltere which looks like a tiny golf tee. Fly antennae may be short or long and of various shapes. The eyes are usually large. The mouthparts are never of the chewing type, but are adapted for piercing plants or animals and sucking the sap or blood. In some cases, the mouthparts may be capable of only sponging up liquid food on surfaces. House flies are able to feed on solid food by first dissolving it with their vomit.

Flies have a complete metamorphosis, and the larvae are usually called maggots. Mosquito larvae are called wigglers, and their pupae are called tumblers. Mosquito tumblers are one of the few kinds of pupae that actively move about.

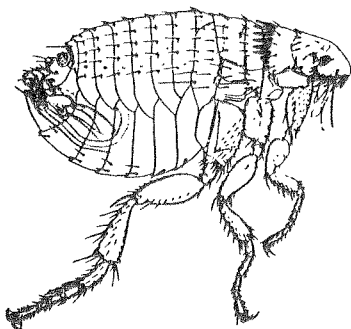
Many kinds of flies are serious economic pests of plants and animals. Flies are the most important insects in regards to the health of man and animals because of the diseases they spread. Many kinds of flies are beneficial as parasites and predators of pest insects or as plant pollinators.

When writing the common names of true fly species, "fly" is always written as a separate word, such as house fly, deer fly, or stable fly. When "fly" is part of the name of other insects, it is written in combination, such as dragonfly, butterfly, caddisfly, etc.

21. SIPHONAPTERA

(from the Greek siphon = tube + aptera = without wings)

(Common name: fleas)



Flea

Siphonaptera are always wingless and with sucking mouthparts—which is the basis of their scientific name. They are flattened from side to side, have long legs and are able to jump. Their antennae are short and the eyes are usually present. On the common species there are combs of stout spines either around the mouth or on the thorax or both places. They are all parasites on the bodies of mammals or birds. Sheep and aquatic mammals are not bothered. Fleas lay their eggs off the host. When the larvae hatch they feed on bits of skin and hair in the host animal's lair or den. After several molts the larva pupates. When the adult emerges from the pupa, it is hungry but can go for months without food. Most flea species prefer one or two types of host, but they often will take experimental tastes of other animals. Dog and cat fleas will bite humans but will not stay on them.

One of the most dread diseases of the past was bubonic plague, which was spread by fleas from rat to man and man to man. Bubonic plague, or the "Black Death," killed 70,000 people in London, England between 1664 and 1666. In the 1500's this Black Death claimed 25 million lives in Europe. Other diseases are also spread by fleas.

22. HYMENOPTERA

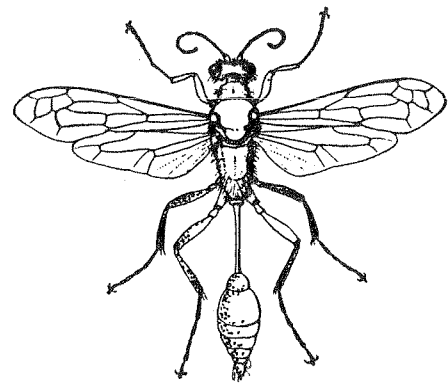
(from the Greek hymen = membrane + ptera = wings)

(Common names: bees, wasps, ants, hornets, sawflies, horntails)

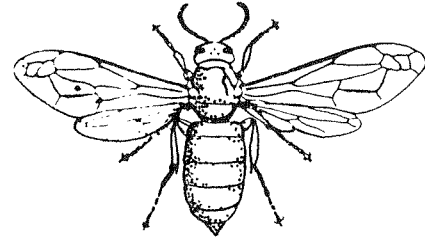
Hymenoptera have chewing mouthparts and two pairs of membraneous wings or none. When winged, the front pair is longer than the hind pair. The antennae are well developed and often are quite long. In bees, wasps and ants, the body is constricted between the thorax and abdomen, but in sawflies and horntails the abdomen and thorax are broadly joined. All Hymenoptera develop by complete metamorphosis.

Some Hymenoptera lead solitary lives. Others are organized into highly socialized colonies. The greatest degree of social organization occurs among the honey bees, but ants are also highly socialized. The social organization of wasps is not so complex. None of the sawflies or horntails are socialized to cooperate to get food, rear young or defend the nest.

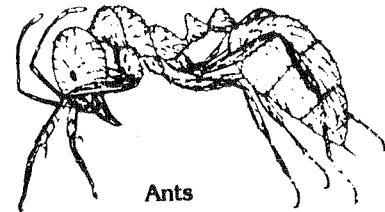
Many of the Hymenoptera, in the process of feeding on pollen, also pollinate flowers and are useful insects for this reason. Honey bees also produce honey, wax and propolis. Other Hymenoptera are beneficial predators or parasites of pest insects. Sawflies and horntails are pests because they feed on leaves or bore in wood. Some bees, wasps and ants are also pests in various ways. Those that can sting cause the most concern. Some people are highly allergic to such stings and may even die as a result of stings.



Thread-waisted wasp



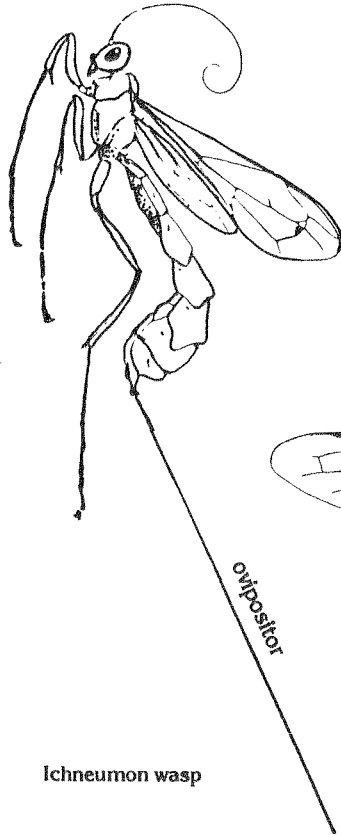
Hornet



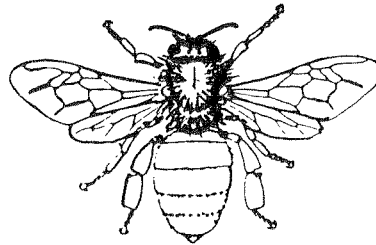
Ants



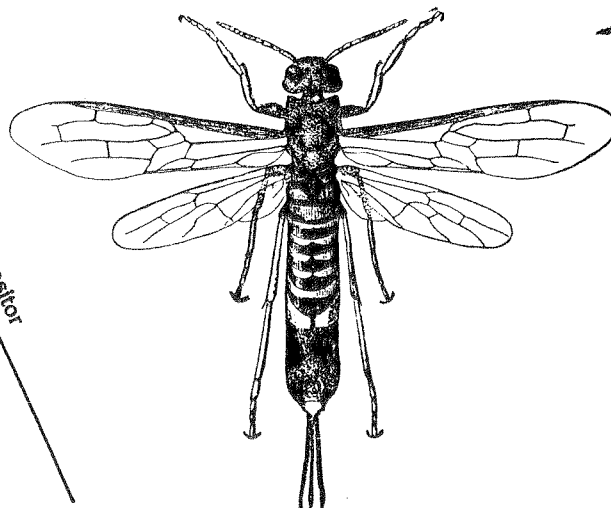
Velvet ants



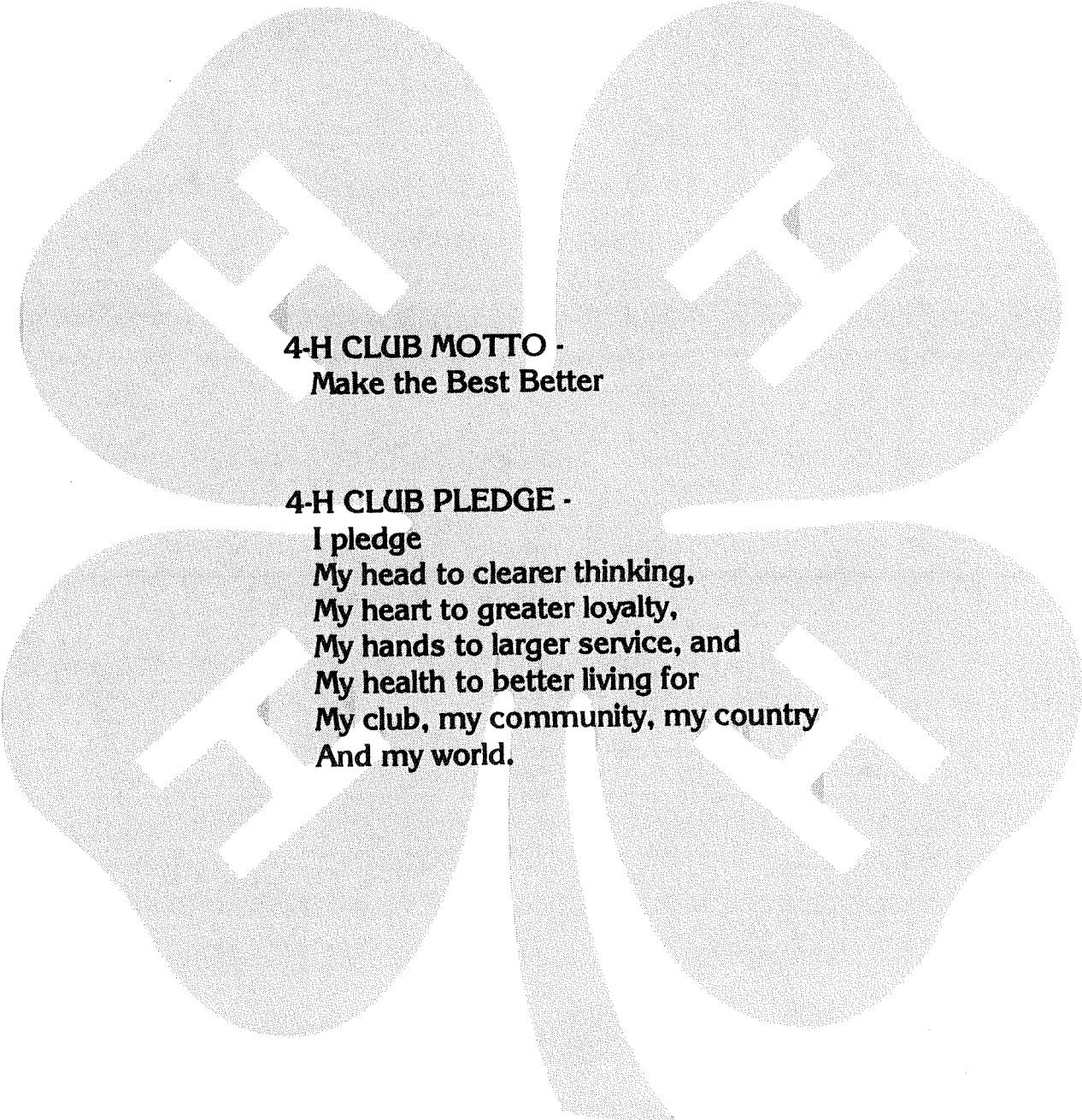
Ichneumon wasp



Honey bee



Horntail



**4-H CLUB MOTTO -
Make the Best Better**

**4-H CLUB PLEDGE -
I pledge
My head to clearer thinking,
My heart to greater loyalty,
My hands to larger service, and
My health to better living for
My club, my community, my country
And my world.**