Appendix

Key for Determining Order of Insects

How to Use a Key

To use a key in determining insects you have two choices or a couplet. After deciding which description fits the specimen you are determining, go to the number indicated to the right of the couplet, ignoring all previous numbers. For example, take two specimens easy to collect, such as a house fly and a honey bee or bumble bee.

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

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

Some keys have a parenthesis after the first number of the couplet. The number refers to the couplet from which you came. The parenthesis has an advantage in that it helps you work backwards and check yourself if you think you made a mistake.

1	Wingless insects	2
1'	Winged insects	12

I Wingless Insects

2 (1)	Mouthparts sucking (a sucking tube usually evident but in the parasitic sucking life, Anoplura, stylets sometimes withdrawn into head	3
2'	Mouthparts chewing (mandibles sometimes retracted and concealed	6
3 (2)	Ectoparasites live on birds or mammals; body flattened dorsoventrally (from top to bottom) or laterally (from side to side	4
3'	Free living: body not usually flattened	5
4 (3)	Body flattened laterally; jumping insects	**Siphonaptera** (Fleas)
4'	Body flattened dorsoventrally; tarsi with one large claw	**Anoplura** (Sucking Lice)

5 (3')	Body long and narrow; mouthparts coneshaped and arising from front of head ..... **Thysanoptera** (Thrips)
5'	Body oval; mouthparts a long sucking tube and arising from hind part of head ..... **Homoptera** (Aphids, Scales, Leafhoppers, Cicadas)
6 (2')	Ectoparasites on birds or mammals; antennae with five or fewer segments; no springing appendage near end of abdomen ..... **Mallophaga** (Chewing Lice)
6'	Not ectoparasites; free living; antennae 6 or more segments (except some springtails, Collembola, which has 4 or 5 segments and springing appendage near end of Abdomen) 7
7 (6')	Abdomen with two or three threadlike appendages ("tails") ..... **Thyansura** (Bristletails, Silverfish)
7'	Abdomen lacking threadlike appendages 8
8	Abdomen constricted at base; antennae usually elbowed ..... **Hymenoptera** (Bees, Wasps, Ants)
8'	Abdomen not constricted at base; antennae not elbowed 9
9 (8')	Abdomen and antennae with 6 or fewer segments; usually with a forked spring appendage near end of abdomen ..... **Collembola** (Springtails)
9'	Abdomen and antennae with more than 6 segments; no ventral springing organ 10
10 (9')	Tarsi 2 or 3 segmented with compound eyes: no cerci ..... **Psocoptera (Corrodentia)** (Book and Barklice)
10'	Tarsi 4 or 5 segmented; with cerci 11
11(10')	Tarsi 4 segmented; small whitish softbodied colonial insects ..... **Isoptera** (Termites)
11'	Tarsi 5 segmented; not as above (roaches and walkingsticks) ..... **Orthoptera** (Grasshoppers, Crickets, Cockroaches)

I' Winged Insects

Except for the Odonata, some wingless forms occur in all the other orders of insects. This key will help determine members of those orders that are usually winged.

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

12 (1')	With two wings ..... **Diptera** (Flies, Mosquitoes, Midges)
12'	With four wings 13

13 (12') Wings covered with scales ..... **Lepidoptera**
(Butterflies, Moths, Skippers)

13' Wings not covered with scales 14

14 (13') With distinct sucking or sucking-rasping tubular mouthparts, without mandibles 15

14' With chewing or vestigial mouthparts (bees, Hymenoptera, have elongated tonguelike structure but with mandibles evident) 17

15 (14) Wings long and narrow and fringed with long hair ..... **Thysanoptera**
(Thrips)

15' Wings not fringed with long hair 16

16 (15') Beak arising from front part of head; front wings leathery at base and membranous at tip ..... **Hemiptera**
(True Bugs)

16' Beak arising from hind part of head; front wings membranous throughout ..... **Homoptera**
(Aphids, Scales, Leafhoppers, Cicadas)

17 (14') Hindwings usually shorter and much smaller in area than forewings 18

17' Hindwings are as large as or larger than forewings 21

18 (17) With long cerci; antennae short, bristlelike and inconspicuous ..... **Ephemeroptera (Ephemerida)**
(Mayflies)

18' Without cerci; antennae longer than head and conspicuous 19

19 (18') Wings distinctly hairy; venation in front and hindwings similar; antennae as long or longer than body ..... **Trichoptera**

19' Wings not hairy; fewer veins and cells in hindwings than in forewings; antennae shorter than body 20

20 (19') Tarsi 2 or 3 segmented; small insects less than 3/8-inch in length ..... **Psocoptera (Corrodentia)**
(Book and Barklice)

20' Tarsi 4 or 5 segmented (usually 5 segmented); large insects (except for small parasites and winged ants); the specimens you collect will usually exceed 1/4 inch in length ..... **Hymenoptera**
(Bees. Wasps, Ants)

21 (17') Front wings horny, leathery or thicker at base 22

21' Wings membranous throughout 24

22 (21) Abdomen with forceps-like cerci ..... **Dermaptera**
(Earwigs)

22' Abdomen without forceps-like cerci 23

23 (22') Front wings without veins and usually meeting in a straight line down back; antennae with less than 12 segments; abdomen with cerci ..... **Coleoptera** (Beetles)

23' Front wings with veins and held roof-like over back or over-lapping; antennae with less than 12 segments; abdomen with cerci ..... **Orthoptera** (Grasshoppers, Crickets, Cockroaches)

24 (21') Head prolonged ventrally into a beak ..... **Mecoptera** (Scorpionflies)

24' Head not prolonged into a beak-like structure 25

25 (24') Antennae short, bristle-like and inconspicuous ..... **Odonata** (Dragonflies, Damselflies)

25' Antennae long and conspicuous 26

26 (25') Cerci present; tarsi 3 segmented ..... **Plecoptera** (Stoneflies)

26' Cerci absent; tarsi 5 segmented ..... **Neuroptera** (Dobsonflies, Lacewings, Ant Lions)

Preserving Immature Insects and Other Arthropods

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

What to do:
Kill the specimen in hot water (180° F). It may take one to several minutes.

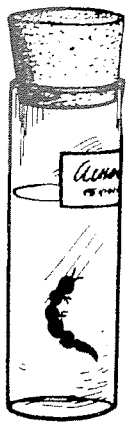
Fill the vial with 70 percent alcohol and drop the specimen in the vial.

With a soft lead pencil write on a piece of index card (that will fit inside the vial) where collected, date, host, name of insect and your name.

Place the label in the vial and cork or cap tightly.

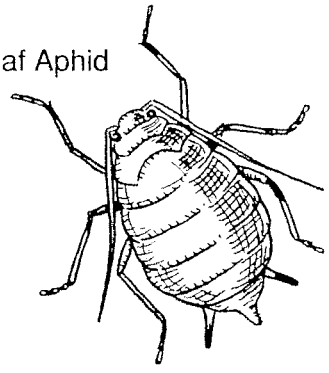
Note: A mixture of one part ethyl acetate (acetic ether) and eight parts of 70 percent alcohol retains color in insects better than 70 percent alcohol used alone. Labels made with ink instead of lead pencil will fade and become hard to read through the vial. Labels placed on the outside of the vials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

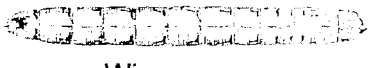
Some members may wish to use vials and alcohol to preserve other than immature insects that cannot be mounted on points. Such insects as aphids, thrips, lice, booklice, termites and snowfleas can be preserved in this manner. Other arthropods, such as centipedes, millipedes, spiders, mites and ticks also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



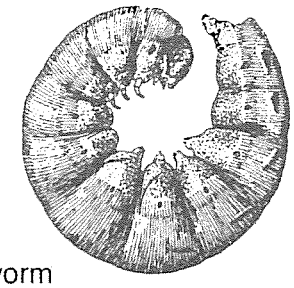
Alcohol Vial

Leaf Aphid

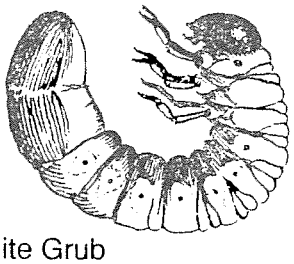




Wireworm



Cutworm



White Grub