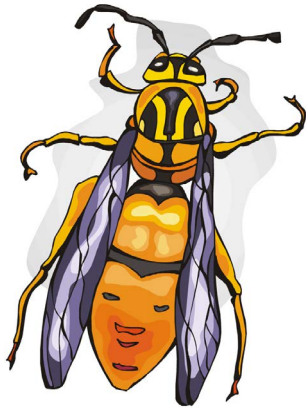


4-H Insect Identification Contest: Study Guide for Senior 4-H'ers



Insects are our most abundant form of wildlife. There are more species of insects than there are species of all other animals and plants combined! Your backyard is inhabited by hundreds of insect species, each with its own unique and interesting biology and habit. Learning about wildlife is rewarding and fun, and the first step in learning about any type of wildlife is identifying what you are looking at.

Learning to identify insects by participating in the 4-H insect identification contest can provide lifelong benefits. Not only will you be able to identify pest insects and understand how to control them, but you will also be better prepared for high school and college biology classes. You will be a better naturalist with a greater understanding and appreciation of the complexity of life and the world in which you live.

The objective of the 4-H insect identification contest is for contestants to learn the basic biology of insects and related organisms, to be able to identify insects to the order level, and to be able to identify 100 of the more common insects and arachnids by their common name.

Although this study guide is primarily intended to help 4-H'ers prepare for the insect identification contest, it can also be used by high school science teachers to help teach students about insects and insect identification. High school students who enjoy learning about insects and other wildlife might even want to participate in the 4-H insect identification contest.

Reference materials for this contest include the following publications:

- This study guide (available online or from **your local Extension office**)
- **Publication 0317 4-H Introduction to Entomology** (available online or from your local Extension office)
- Publication 2297 *4-H Entomology Manual* (available from your local county Extension office)
- *National Wildlife Federation Field Guide to Insects and Spiders and Related Species of North America* by Arthur V. Evans (available through libraries and booksellers). This guide includes general information on the biology of insects, spiders, and related arthropods, along with color photographs and basic information for all the insects listed in this study guide. Other field guides and older editions can also be useful, but these guides may include outdated or alternative order classifications.

The Contest

The state contest is divided into two parts: specimen identification and a written quiz. Specimens may be pinned, preserved in alcohol, shown in photographs, or shown in visual projections. You will be asked to provide information about the specimen. For example, you may be asked to give either the order or common name of the specimen or to indicate the type of life cycle or type of mouthparts. For the written quiz, you will be asked to provide answers to questions about insect biology and habits. Contestants who know the orders of insects, can identify the insects on the study list by their common name, and are familiar with the information in the *4-H Entomology Manual* will do well in the contest.

Realize They Are Not All Insects

The orders of insects and arachnids list (Table 1) and the insect identification study list for seniors (Table 2) provide a few groups or species of land-dwelling creatures that are not insects but do belong to a closely related group of arthropods. These other land-dwelling arthropods are included because they are usually studied by entomologists; it is also important to be able to recognize these creatures and to know they are not insects.

Pay Attention to Size

When taking close-up photos of insects, the goal is usually to fill the frame with the specimen to show as much detail as possible. This means that, in most field guides, a flea and a bumble bee will appear about the same size. However, any good field guide will also give information about the approximate length of mature specimens, and it is important to make note of this. When reading about an insect you have never seen before, it can be helpful to look at a ruler and visualize just how long the insect is. Of course, seeing or collecting actual specimens is the best way to learn the size of a particular insect species!

Also, keep in mind that there can be considerable size variation among mature specimens of many insect species. For example, some bumble bees can be more than three times larger than other specimens of the same species. Insects do not grow once they reach the adult stage, but the nutrition they receive in the immature stage has a great influence on adult size.

Know What You Don't Know

Contestants should recognize that the 100 insects on the study list represent only a small fraction of the insect species in the state. In the senior division, contestants may be presented with a few specimens of insects that are not on the study list. If this is done, you will be told at the beginning of the contest, and you will be told how many "off list" specimens there are. In this case, you do not need to correctly identify the specimen. An answer of "not on list" or "I do not know" will be counted as correct. If you happen to know the insect and correctly identify it, your answer will also be counted correct, but you will not get extra credit. For example, if a squash bee or sweat bee is presented and you are asked to supply the common name, you should identify it as "not listed" or "do not know" rather than calling it a honey bee. However, if asked to give the order, type of mouthparts, or type of life cycle for an "off list" specimen, you should be able to do so. The reason for including a few "off list" specimens in the identification contest is that, when identifying insects, it is as important to know what you don't know as it is to know what you should know.

Pay Attention to Spelling

Contestants should strive to spell common names and order names correctly. Answers that are badly misspelled will be counted as incorrect, and spelling may be used to break ties.

It is also helpful to understand why the common names of some insects are written as one word, as in "dragonfly," while those of other insects are written as two words, as in "house fly." In general, when an organism really is a member of the group being named, the name is written as two words. If the organism does not really belong to that group, then the name is written as one word. For example, dragonflies, butterflies, and fireflies are not really flies, but house flies and horse flies are. Likewise, hornworms are not really worms, but honey

bees really are bees. Also, entomologists use the word "bug" only to refer to a certain subgroup of the order hemiptera: stink bugs, squash bugs, ambush bugs, etc. This is why when lady beetles are referred to as "ladybugs," it is written as one word. To an entomologist, ladybugs are not true bugs, just as antlions are not really lions, and silverfish are not really fish.

The Study List

The study list (Table 2) contains the common names of 100 insects and related arthropods. While some of these names refer to a specific insect, many are names for groups of insects, and there may be dozens, even hundreds, of different species within the group. For example, head louse, monarch butterfly, Colorado potato beetle, and cicada killer are common names for specific insects, but termite, lady beetle, mosquito, and longhorn beetle are names for groups of insects. There are several different species of termites, dozens of different species of lady beetles and mosquitoes, and hundreds of different species of longhorn beetles.

In cases where the listed name represents an insect group, you are not expected to be able to identify individual species within the groups. However, you should be familiar enough with the characteristics of the listed group to be able to identify a member of the group regardless of which particular species is presented. For example, whether presented with a specimen of a cottonwood borer, a locust borer, or an ivory-marked beetle, the contestant should be able to identify the specimen as a longhorn beetle. This is similar to being able to tell whether a particular dessert is a cookie, a pie, or a cake even though you may not know exactly what kind of cookie, pie, or cake it is.

You should be able to identify any specimen to the order level and tell what type of life cycle or mouthparts a specimen has even if it is not on the common names list. For example, if you are presented with a specimen of an eastern Hercules beetle or any other beetle species, you should be able to identify it as a member of the order Coleoptera and know that it has chewing mouthparts and a complete life cycle. Likewise, if presented with a caterpillar or any adult moth or butterfly, you should be able to recognize it as a member of the order Lepidoptera.

Refer to the book *National Wildlife Federation Field Guide to Insects and Spiders and Related Species of North America* by Arthur V. Evans to become familiar with the listed insects. Most specimens presented in the contest will be species illustrated in this field guide. It will also be helpful to view other photos and illustrations of the listed insects using online sources or other field guides. Collecting or observing actual specimens is an even better way to study!

Order

Learning to identify the different orders of insects is the key to learning how to identify insects. Learning the orders is not nearly as difficult as it might seem at first. There are only 31 orders, and eight of these (marked with an asterisk in the order table) are so uncommon that you do not need to know them for the contest. See Table 1 for a list of the orders you need to know.

The names of many orders end in “-ptera,” which means *wing*. Learning the wing characteristics for an order can help you quickly identify most adult insects that belong to that order. For example, moths and butterflies, order Lepidoptera (scale wing), have scales on their wings that rub off on your fingers when you touch them. Beetles, order Coleoptera (sheath winged), have hard, sheath-like front wings. Some order names end in “-aptera,” which means *without wings*. Fleas, which have sucking mouthparts and no wings, are in the order Siphonaptera (“Siphon” for tube or pipe and “-aptera” for without wings). See the appropriate pages in the *4-H Entomology Manual* and the suggested field guide for more details about insect orders and order names.

Insects within an order have many traits and habits in common, and if you know which order an insect belongs to, you know a lot of other information about that insect. For example, all Diptera have a complete life cycle, and adult flies have sucking or sponging mouthparts. All Hemiptera have a gradual life cycle and have sucking mouthparts as adults and as nymphs. Knowing the orders really is the key to knowing insects! You do not have to memorize what type of mouthparts and life cycle each insect species has. You just have to know what order it is in and what type of life cycle and mouthparts are characteristics of that order.

Host

This column indicates only a few of the more common hosts or food sources of the listed insect. Contestants should recognize that most of the listed insects have many more hosts that are not listed. For example, horn flies feed primarily on cattle but will also feed on horses, goats, and many other animals. For contest purposes, contestants should list the hosts indicated on the study list. Hosts listed for Lepidoptera are for the larval stage.

Mouthparts

All insects do not feed in the same way. Some feed on plants by eating the leaves or by boring through fruit, stems, or trunks. Others feed on plants by sucking sap, and still others feed on animals by sucking blood. Moths and butterflies use siphoning mouthparts to suck nectar from flowers through a long, thin proboscis. Some flies have sponging/sucking type mouthparts, and some adult insects do not have working mouthparts at all because they do not live very long and do not feed as adults. Knowing what type of mouthparts an insect has can help

you know what type of damage it will cause; if the insect is a pest, this information can even help determine which kinds of control will work best.

For purposes of this contest, we will refer to the following five types of mouthparts:

- **Chewing (C)**—Distinguished by a pair of strong mandibles and a smaller pair of maxillae. Characteristic of beetles, caterpillars, and several other orders.
- **Piercing/sucking (P/S)**—Distinguished by an elongated, hollow proboscis used to pierce the plant, animal, or insect being fed upon and suck up sap or blood. Characteristic of the Hemiptera and many flies, such as mosquitoes.
- **Chewing and sucking (C&S)**—Distinguished by having chewing mandibles as well as other mouthparts modified for sucking. Characteristic of bees.
- **Sponging (SP)**—Distinguished by a hollow proboscis with an enlarged, sponge-like structure at the end. Characteristic of house flies and some other flies.
- **Siphoning (SIP)**—Distinguished by a long, hollow proboscis that is usually rolled up when not in use. Characteristic of adult moths and butterflies.

See “How Insects Feed—Mouthparts” in the *4-H Entomology Manual* for more information on insect mouthparts and how insects feed.

Be aware that some insects have one type of mouthpart when they are immature and a completely different type of mouthpart as adults. For example, moths and butterflies have chewing mouthparts in the immature phase and siphoning mouthparts as adults. Also, be aware that some insects have unusual mouthparts that do not fit any of the above categories. For example, immature lacewings and some predatory beetles have hollow mandibles through which they suck the blood of their insect prey. Head lice have sucking mouthparts, but they are not like the piercing/sucking mouthparts of a bed bug. The sucking mouthparts of spiders, ticks, and mites do not fit any of the above categories exactly.

Pest Status or Harmful Stage

The information in this column indicates whether a particular insect or group of insects is considered to be a pest, a beneficial, or neutral (not a pest). If the insect is a pest, the harmful stage is indicated. Contestants should recognize that this information is somewhat subjective in nature, and there are often exceptions. For example, cicadas are not usually pests, but large numbers of periodic cicadas can damage fruit trees by causing twigs to break where they insert their eggs. Even though adult females can sting if mishandled, cicada killers are also listed as “not pests” because stings are very rare. Similarly, praying mantids are not listed as being beneficial, even though they are predators of other insects, because they usually prey on insects that are not pests.

Contest Preparation

When participating in the contest, answer questions based on the information presented in the study guide—even if you are aware of exceptions to the general information given in the study guide. Biology is not always an exact science; it is often a science of generalities and exceptions to those generalities.

Table 1. Orders of insects and arachnids.

Order	Members	Life cycle	Type of mouthparts
Class Entognatha			
Protura*	proturans	none	chewing
Collembola	springtails	none	chewing or sucking
Diplura*	diplurans	none	chewing
Class Insecta			
Thysanura	silverfish and firebrats	none	chewing
Microcoryphia*	bristletails	none	chewing
Orthoptera	grasshoppers and crickets	gradual	chewing
Blattodea	cockroaches	gradual	chewing
Mantodea	praying mantids	gradual	chewing
Phasmida	stick insects	gradual	chewing
Grylloblattodea*	rock crawlers	gradual	chewing
Mantophasmatodea*	mantophasmids	gradual	chewing
Isoptera	termites	gradual	chewing
Plecoptera	stoneflies	incomplete	chewing
Dermaptera	earwigs	gradual	chewing
Embioptera*	web-spinners	gradual	chewing
Psocoptera	barklice and booklice	gradual	chewing
Phthiraptera	chewing lice and sucking lice	gradual	chewing or sucking
Zoraptera *	zorapterans	gradual	chewing
Hemiptera¹	true bugs, cicadas, leafhoppers, fulgorids, aphids, whiteflies, and scales	gradual	piercing/sucking
Ephemeroptera	mayflies	incomplete	chewing (immature), none (adult)
Odonata	dragonflies and damselflies	incomplete	chewing
Thysanoptera	thrips	complete	piercing/sucking
Neuroptera²	lacewings, antlions, dobsonflies, and snakeflies	complete	chewing
Coleoptera	beetles	complete	chewing
Strepsiptera*	twisted-wing parasites	complete	chewing
Mecoptera	scorpionflies	complete	chewing
Siphonaptera	fleas	complete	chewing (immature), piercing/sucking (adult)
Diptera	flies	complete	chewing (immature), sucking or sponging (adult)
Trichoptera	caddisflies	complete	chewing (immature), sucking (adult)
Lepidoptera	butterflies and moths	complete	chewing (immature), siphoning (adult)
Hymenoptera	ants, bees, and wasps	complete	chewing or chewing and sucking

Order	Members	Life cycle	Type of mouthparts
Common orders of arachnids, Class Chelicerata			
Araneae	spiders	gradual	sucking
Acari	ticks and mites	gradual	sucking
Opiliones	harvestmen	gradual	chewing
Scorpiones	scorpions	gradual	sucking
Pseudoscorpiones	pseudoscorpions	gradual	sucking

*Orders followed by an asterisk are uncommon and are rarely seen by most amateur entomologists. Specimens from these orders will not be included in the contest.

¹Earlier books divide the Hemiptera into two orders: Hemiptera (true bugs) and Homoptera (cicadas, leafhoppers, fulgorids, aphids, whiteflies, and scales).

²Some books, including the *Field Guide to Insects and Spiders and Related Species of North America*, place dobsonflies and snakeflies in separate orders, but for contest purposes, they are considered to be Neuroptera.

Table 2. Insect identification study list for seniors.

Insect*	Order	Host	Life cycle	Mouthparts	Pest status or harmful stage
ambush bug	Hemiptera	predator	gradual	P/S	Not pests
American cockroach	Blattodea	food products	gradual	C	Nymphs and adults
antlion (i)	Neuroptera	predator	complete	sucking (i)	Not pests
aphids	Hemiptera	succulent plants	gradual	P/S	Nymphs and adults
baldfaced hornet	Hymenoptera	predator	complete	C	Adults (will sting if disturbed)
barklouse	Psocoptera	fungi and lichens	gradual	C	Not pests
bed bug	Hemiptera	humans	gradual	P/S	Nymphs and adults
black and yellow mud dauber	Hymenoptera	spiders	complete	C	Adults (nests can damage equipment)
black carpenter ant	Hymenoptera	insects and honeydew (nests in wood)	complete	C	Adults
black soldier fly	Diptera	decaying organic matter	complete	C (i)	Larvae and adults
black swallowtail butterfly (i)	Lepidoptera	parsley, dill, and fennel	complete	C (i)	Larvae (pests in herb gardens); adults welcome in butterfly gardens
black widow spider	Araneae	predator	gradual	sucking	Immatures and adults (bite is venomous)
boll weevil	Coleoptera	cotton	complete	C	Larvae and adults (eradicated from Mississippi)
brown recluse spider	Araneae	predator	gradual	sucking	Immatures and adults (bite is venomous)
bumble bee	Hymenoptera	pollen and nectar	complete	C&S	Beneficial but will sting if disturbed
caddisfly	Trichoptera	algae and aquatic plants	complete	C (i)	Not pests
carpenter bee	Hymenoptera	pollen and nectar	complete	C&S	Adults (bore galleries in wood)
cecropia moth (i)	Lepidoptera	leaves of many trees	complete	C (i)	Not pests
chinch bug	Hemiptera	corn and St. Augustine grass	gradual	P/S	Nymphs and adults
 cicada	Hemiptera	roots of trees	gradual	P/S	Not pests
cicada killer	Hymenoptera	cicadas	complete	C	Not pests (adults can sting)
Colorado potato beetle	Coleoptera	potato and tomato	complete	C	Larvae and adults
Common house spider	Araneae	predator	gradual	sucking	Immatures and adults (webs are unsightly)
corn earworm (i)	Lepidoptera	corn, cotton, and vegetables	complete	C (i)	Larva
cottony cushion scale	Hemiptera	shrubs	gradual	P/S	Nymphs and adults
crane fly	Diptera	grass thatch	complete	C (i)	Not pests
cucumber beetle, 12-spotted	Coleoptera	general garden feeders	complete	C	Adults
dragonfly (i)	Odonata	predator (eats mosquitoes)	incomplete	C	Beneficial: niad and adult
earwig	Dermaptera	predator (some plant-feeding)	gradual	C	Immatures and adults (can damage rose blooms)
eyed click beetle	Coleoptera	predator	complete	C	Not pests
field cricket	Orthoptera	general plant feeders	gradual	C	Nymphs and adults
fiery searcher	Coleoptera	caterpillars	complete	C	Beneficial
firefly	Coleoptera	wild flowers	complete	C	Not a pest
flea	Siphonoptera	mammals	complete	P/S	Adults
German cockroach	Blattodea	food products	gradual	C	Nymphs and adults
golden silk orb weaver	Aranea	predator	gradual	sucking	Not pests
granary weevil	Coleoptera	stored grains	complete	C	Larvae and adults
grasshopper	Orthoptera	general plant feeders	gradual	C	Nymphs and adults
green bottle fly	Diptera	feces and carrion	complete	S	Adults

Insect *	Order	Host	Life cycle	Mouthparts	Pest status or harmful stage
green lacewing	Neuroptera	predator	complete	sucking (i)	Beneficial: larvae
green stink bug	Hemiptera	plant seeds and fruits	gradual	P/S	Nymphs and adults
harlequin bug	Hemiptera	cabbage	gradual	P/S	Nymphs and adults
harvestman	Opiliones	predator/scavenger	gradual	chewing	Not pests
head louse	Phthiraptera	people	gradual	P/S	Nymphs and adults
honey bee	Hymenoptera	pollen and nectar	complete	C&S	Beneficial (but will sting if disturbed)
horned passalus	Coleoptera	decaying logs	complete	C	Not pests
horn fly	Diptera	cattle	complete	P/S	Adults
hornworm (i)	Lepidoptera	tomato, pepper	complete	C (i)	Larvae
horse fly	Diptera	livestock	complete	P/S	Adults
house fly	Diptera	garbage, manure (i)	complete	SP	Adults
hummingbird moth	Lepidoptera	honeysuckle (i)	complete	C (i)	Not pests
ichneumon wasp	Hymenoptera	parasites of other insects	complete	C	Beneficial
imported fire ant	Hymenoptera	insects and seeds	complete	C	Adults (sting if disturbed)
Indian meal moth	Lepidoptera	grains and dried stored foods	complete	C (i)	Larvae
jewel beetles	Coleoptera	larvae bore in trees	complete	C	Larvae
lace bug	Hemiptera	azalea, eggplant, pyracantha	gradual	P/S	Nymphs and adults
lady beetle (i)	Coleoptera	predator	complete	C	Beneficial: larvae and adults
leaf-footed bug	Hemiptera	vegetables and fruits	gradual	P/S	Nymphs and adults
leafhopper	Hemiptera	most plants	gradual	P/S	Nymphs and adults
longhorn beetles	Coleoptera	larvae bore in trees	complete	C	Larvae
luna moth (i)	Lepidoptera	leaves of hardwood trees	complete	C (i)	Not pests
May beetle (i)	Coleoptera	roots of grasses (i)	complete	C	Larvae and adults
mayfly	Ephemeroptera	aquatic plants and detritus (i)	incomplete	C (i)	Adults (nuisance when numerous)
mealybugs	Hemiptera	various plants	gradual	P/S	Nymphs and adults
Mexican bean beetle	Coleoptera	beans, cowpeas	complete	C	Larvae and adults
mole cricket	Orthoptera	roots of grasses	gradual	C	Nymphs and adults
monarch butterfly (i)	Lepidoptera	milkweed plants (i)	complete	C (i)	Not pests
mosquito	Diptera	blood of mammals	complete	P/S	Adults
paper wasp	Hymenoptera	predator	complete	C	Adults (will sting if disturbed)
Polyphemus moth	Lepidoptera	leaves of hardwood trees	complete	C (i)	Not pests
praying mantid	Mantodea	predator	gradual	C	Not pests
pseudoscorpion	Pseudoscorpiones	predator	gradual	sucking	Not pests
red-spotted purple butterfly (i)	Lepidoptera	willow and poplar	complete	C (i)	Not pests
robber fly	Diptera	predator	complete	P/S	Not pests
scorpionfly	Mecoptera	insects and decaying vegetation	complete	C	Not pests
silverfish	Thyanura	cotton clothing, paper	none	C	Immatures and adults
soldier beetle	Coleoptera	pollen	complete	C	Not pests
soybean looper (i)	Lepidoptera	soybeans, other plants	complete	C (i)	Larvae
spider mite, two-spotted	Acari	many plants	gradual	sucking	Immatures and adults
springtail	Collembola	fungi and decaying vegetation	none	chewing	Not pests
squash bug	Hemiptera	curcubits	gradual	P/S	Nymphs and adults
squash vine borer	Lepidoptera	squash and pumpkins	complete	C (i)	Larvae
stable fly	Diptera	livestock	complete	P/S	Adults

Insect *	Order	Host	Life cycle	Mouthparts	Pest status or harmful stage
stonefly	Plecoptera	plant material (i)	incomplete	C	Not pests
striped blister beetle	Coleoptera	vegetables and crops	complete	C	Adults
tarnished plant bug	Hemiptera	many plants	gradual	P/S	Nymphs and adults
termite	Isoptera	wood, paper	gradual	C	Nymphs and adults
thrips	Thysanoptera	plants, leaves, or flowers	complete	P/S	Larvae and adults
tick	Acari	mammals and other animals	gradual	sucking	Immatures and adults
tiger beetle	Coleoptera	predator	complete	C	Not pests
tiger swallowtail butterfly	Lepidoptera	various trees	complete	C (i)	Not pests
true katydid	Orthoptera	leaves of trees	gradual	C	Not pests
varied carpet beetle	Coleoptera	wool and silk fabrics, feathers and fur	complete	C	Larvae
velvet ant	Hymenoptera	parasites of ground-nesting bees and wasps	complete	C	Not pests (adults can sting)
viceroy butterfly	Lepidoptera	willow and other trees	complete	C (i)	Not pests
vinegar fly	Diptera	ripe fruit	complete	SP	Larvae and adults
walkingstick	Phasmida	leaves of trees	gradual	C	Not pests (two-striped walkingsticks can release a spray that causes temporary blindness)
white-fringed beetle	Coleoptera	vegetables and crops	complete	C	Larvae and adults
yellow garden spider	Araneae	predator	gradual	sucking	Not pests
yellowjacket	Hymenoptera	insects	complete	C	Adults (sting if disturbed)

(i) = immature (meaning that the host or type of mouthparts listed are for the immature stage)

*In most cases, contestants will be expected to identify adult insects, but when the common name is followed by an (i), you should be able to identify either the adult or the immature stage.

Contestants may use the following abbreviations for mouthparts (or may use complete spelling):

C = chewing P/S = piercing/sucking C&S = chewing and sucking SP = sponging Sucking = sucking (as in spiders, ticks, and spider mites)

Publication 2591 (POD-04-24)

By **Blake Layton**, PhD, Extension Professor, Biochemistry, Molecular Biology, Entomology, and Plant Pathology.

Copyright 2024 by Mississippi State University. All rights reserved. This publication may be copied and distributed without alteration for nonprofit educational purposes provided that credit is given to the Mississippi State University Extension Service.

Produced by Agricultural Communications.

Mississippi State University is an equal opportunity institution. Discrimination in university employment, programs, or activities based on race, color, ethnicity, sex, pregnancy, religion, national origin, disability, age, sexual orientation, gender identity, genetic information, status as a U.S. veteran, or any other status protected by applicable law is prohibited.

Extension Service of Mississippi State University, cooperating with U.S. Department of Agriculture. Published in furtherance of Acts of Congress, May 8 and June 30, 1914. ANGUS L. CATCHOT JR., Director

