

4-H Insect Identification Study Guide for Junior 4-H'ers

What is it? This is the first question most people ask when they encounter a new kind of animal. Being able to identify an animal is the first step in learning about that animal. Your backyard is home to hundreds of different species of interesting and unusual animals, and most of these animals are insects. Insects affect our lives in many ways. Some insects are pests and some are beneficial, but most insects are neither good nor bad—they are just little animals.

Participating in the 4-H Insect Identification contest will help you learn how to identify insects and learn about the biology and habits of these interesting little animals. For the junior level contest, you only need to learn about 50 of our more common insects, but the skills you acquire in learning about these 50 insects will help you expand your knowledge of insects, as well as other animals and plants, as you move through life.

Reference materials for this contest include the following publications:

- This study guide (available online or from [your local county Extension office](#))
- Mississippi State University Extension [Publication 317 4-H Introduction to Entomology](#) (available online or from your local county Extension office)
- Publication 2297 *4-H Entomology Manual* (available only through 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 Other field guides and older editions can also be useful, but these guides may include outdated or alternative order classifications.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 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. You must know the information in this study guide, the *4-H Introduction to Entomology*, and the indicated sections of the *4-H Entomology Manual* (“How Insects Grow and Develop” and “How Insects Feed—Mouthparts”) to do well in the contest.

Spelling Counts

Try to spell common names and order names correctly. Answers that are badly misspelled will be counted wrong, 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 other insect names 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, but 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” to refer only to a certain subgroup of the order hemiptera: stink bugs, squash bugs, ambush bugs, etc. This is why, when a lady beetle is referred to as a “ladybug,” it is written as one word.

The Study Guide

The Orders

There are 31 orders of insects, but most of the insect species in the world belong to one of six orders. If you learn these six orders, you will be able to quickly classify most of the insects you encounter to the order level. Junior contestants will be expected to know only the six orders listed in Table 1. During the specimen identification portion of the contest, you may be presented with an insect and asked to tell which order it belongs to, what type of mouthparts it has, or what its life cycle is. You should be able to recognize members of these six major

Table 1. Major orders of insects.

Order	Members	Life Cycle	Type of Mouthparts
<i>Coleoptera</i>	beetles	complete	chewing
<i>Lepidoptera</i>	butterflies and moths	complete	chewing (caterpillars), siphoning (adults)
<i>Diptera</i>	flies	complete	chewing (immatures), sucking or sponging (adults)
<i>Hymenoptera</i>	ants, bees, and wasps	complete	chewing or chewing & sucking
<i>Hemiptera</i> ¹	true bugs, cicadas, leafhoppers, fulgorids, aphids, whiteflies, and scales	gradual	piercing/sucking
<i>Orthoptera</i>	crickets and grasshoppers	gradual	chewing

Note: There are 31 different orders of insects, but most insects belong to one of the six major orders. Junior contestants should know the key characteristics of these six major orders and be able to identify specimens that belong to these orders.

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

orders even if the species presented is not one of the 50 species listed in the insect identification study sheet. You should be able to tell whether an insect is a beetle or a butterfly, or a member of one of the other four major orders, even if you have never seen that particular species before.

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. See the appropriate pages in the *4-H Entomology Manual* and in the front of the *National Wildlife Federation Field Guide* for more details about insect orders.

Learning the orders is the key to learning entomology because insects that belong to the same order share many common traits. In particular, they all have the same type of life cycle and the same type of mouthparts. Once you know which order an insect belongs to, you will know a lot of other information about that insect. For example, flies are in the order Diptera, and 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 the type of mouthparts and life cycle for each individual species. You just have to know what order it is in and what type of life cycle and mouthparts are characteristic of that order.

Study List

Table 2 contains the common names of 50 insects and related arthropods. While some of these names refer to a specific insect, most 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, bean leaf 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 a group of insects, 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, you should be able to identify the specimen as a longhorn beetle. This is much like being able to identify a cookie when you see one even though you may not know exactly what kind of cookie it is.

Most specimens presented in the contest will be species that are illustrated in the *National Wildlife Federation Field Guide to Insects and Spiders and Related Species of North America* by Arthur V. Evans. Refer to the field guide to become familiar with the listed insects.

Insect Life Cycles

In the insect world, the process of development is referred to as metamorphosis, meaning change in form or appearance. We may simply refer to this change as the life cycle. There are three basic types of insect life cycles that you will need to know: 1) gradual, 2) complete, and 3) ametabolous (without metamorphosis).

Insects with a gradual life cycle go through three stages of development: egg, nymph, and adult. Some insects with this type of development are cockroaches, crickets, stink bugs, and chinch bugs. Many aquatic insects, such as dragonflies, mayflies, caddisflies, and stoneflies have a special type of life cycle that is sometimes referred to as incomplete metamorphosis, but we still refer to it as gradual for the purpose of this study guide and contest.

Insects with a complete life cycle have four stages of development: egg, larva, pupa, and adult. There is a great difference between the immature stages and adults. The larval stage is very active and in many cases is the damaging stage. The pupal stage is the inactive, or resting, stage. Some common insects with this type of development are beetles, butterflies, moths, bees, wasps, and flies.

The third type of development is ametabolous (without metamorphosis). Insects with this type of life cycle never develop wings—the young look just like the adults in every respect. Young insects molt and grow, but their appearance never changes.

See the section on “How Insects Grow and Develop” in the *4-H Entomology Manual* for more information on insect metamorphosis.

Insect 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, and, if it is a pest insect, can even help determine which kinds of control will work best. For the purposes of this contest, we will refer to the following five types of mouthparts:

1. **Chewing (C)**—Distinguished by a pair of strong mandibles and a smaller pair of maxillae. Characteristic of beetles, caterpillars, and several other orders.
2. **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.
3. **Chewing and sucking (C&S)**—Distinguished by having chewing mandibles as well as other mouthparts modified for sucking. Characteristic of bees.
4. **Sponging (SP)**—Distinguished by a hollow proboscis with an enlarged, sponge-like structure at the end. Characteristic of house flies and some other flies.
5. **Siphoning (SIP)**—Distinguished by a long, hollow proboscis that is usually rolled up when not in use. Characteristic of adult moths and butterflies.

See the information on “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 mouthparts as immatures and a completely different type of mouthparts as adults. For example, moths and butterflies have chewing mouthparts as immatures 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.

Table 2. Insect identification study sheet for juniors.

Insect*	Order**	Host	Life Cycle	Mouthparts	Interesting Facts
ambush bug	Hemiptera	predator	gradual	P/S	These are "sit and wait" predators.
aphid	Hemiptera	succulent plants	gradual	P/S	Females usually give birth to live young.
bed bug	Hemiptera	people	gradual	P/S	Bed bugs are becoming more common.
black swallowtail butterfly	Lepidoptera	parsley, fennel, and dill (i)	complete	C (i)	Caterpillars are sometimes called parsleyworms.
black widow spider	Araneae	predator	gradual	sucking	Bite is venomous to people but rarely fatal.
bumble bee	Hymenoptera	feeds on pollen and nectar	complete	S/C	They nest in ground and store honey in honey pots.
cicada	Hemiptera	roots of trees (i)	gradual	P/S	Some species have a 13-year life cycle.
cicada killer	Hymenoptera	cicadas	complete	C	This is our largest wasp.
cockroach	Blattodea	food products	gradual	C	Egg case is called an ootheca.
Colorado potato beetle	Coleoptera	potatoes and eggplant	complete	C	Larvae and adults both feed on leaves.
crane fly	Diptera	grass roots (i)	complete	C (i)	Adults do not feed.
cucumber beetle, 12-spotted	Coleoptera	general garden feeder	complete	C	Grubs are known as southern corn rootworms.
dragonfly	Odonata	predator	gradual	C	The immatures, or niads, are aquatic predators.
earwig	Dermoptera	predator	gradual	C	Pinchers catch prey.
eyed click beetle	Coleoptera	predator	complete	C	These beetles feed on larvae of wood-boring beetles.
field cricket	Orthoptera	plant feeder	gradual	C	Males use structures on their wings to produce songs.
firefly	Coleoptera	predator	complete	C	Adults and larvae produce a cold light.
flea	Siphonaptera	blood of mammals	complete	P/S	Larvae develop in bedding of host. Adults live on hosts, feed on blood.
grasshopper	Orthoptera	general feeders	gradual	C	Eggs are deposited in cells in soil.
green lacewing	Neuroptera	predator (i)	complete	C	Eggs are laid on a stalk.
head louse	Phthiraptera	people	gradual	sucking	Eggs, called "nits," are attached to the base of a strand of hair.
honey bee	Hymenoptera	feeds on pollen and nectar	complete	C&S	The honey bee converts nectar to honey.
horned passalus	Coleoptera	decaying logs	complete	C	Adults and larvae communicate with squeaking sounds.
house fly	Diptera	food, garbage, and manure (i)	complete	SP	House flies only live near humans.
imported fire ant	Hymenoptera	insects and seeds	complete	C	This non-native ant has a painful sting.
lady beetle	Coleoptera	predator	complete	C	Larvae are also predators.
longhorn beetle	Coleoptera	larvae bore in wood (i)	complete	C	Adults have exceptionally long antennae.
luna moth	Lepidoptera	tree leaves (i)	complete	C (i)	The luna moth is a large silkworm moth.
May beetle	Coleoptera	grass roots (i)	complete	C	Larvae are called white grubs.
mayfly	Ephemeroptera	detritus or plants (i)	gradual	C (i)	Adult has no functional mouthparts.
mole cricket	Orthoptera	grass roots	gradual	C	Some species of mole crickets are pests of golf courses.
monarch butterfly	Lepidoptera	milkweed (i)	complete	SP	Adults and caterpillars are toxic to birds.
mosquito	Diptera	blood of animals	complete	P/S	Female sucks blood; male sucks nectar.
paper wasp	Hymenoptera	predator	complete	C	The paper wasp will sting if disturbed.

Insect*	Order**	Host	Life Cycle	Mouthparts	Interesting Facts
polyphemus moth	Lepidoptera	tree leaves (i)	complete	C (i)	This is one of the large silkworm moths.
praying mantid	Mantodea	predator	gradual	C	Mantids are not really beneficial because they rarely feed on insects that are pests.
robber fly	Diptera	predator	complete	P/S	These are the “hawks” of the insect world.
silverfish	Thysanura	paper, cotton, and silk clothing	none	C	These are common in homes.
spider mite	Acari	general plant feeder	gradual	sucking	Spider mites have eight legs; they are not insects.
squash bug	Hemiptera	cucurbits	gradual	P/S	Squash bugs overwinter as adults.
stink bug	Hemiptera	developing fruit and seed	gradual	P/S	The stink bug has a distinctive odor.
striped blister beetle	Coleoptera	vegetables	complete	C	If handled, these can cause blisters on skin.
termite	Isoptera	wood and paper	gradual	C	Termites are beneficial in the woods but pests in buildings.
tick	Acari	mammals and other animals	gradual	sucking	Ticks are not insects; they have eight legs.
tiger beetle	Coleoptera	predator	complete	C	Larvae live in holes in the ground.
tiger swallowtail butterfly	Lepidoptera	various trees (i)	complete	C (i)	Some females are black.
tobacco hornworm (i)	Lepidoptera	tomato leaves (i)	complete	C (i)	The horn on the rear is harmless.
true katydid	Orthoptera	tree leaves	gradual	C	These sing a distinctive song at night.
velvet ant (cow killer)	Hymenoptera	parasite	complete	C	Velvet ants parasitize nests of bumble bees and other ground-nesting bees.
walking stick	Phasmida	tree leaves	gradual	C	The two-striped walking stick can release a spray that can cause temporary blindness.

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

**Junior contestants will be expected to know only the six orders listed in Table 1.

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

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

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

For life cycles: Comp = complete; Grad = gradual; None = none or ametabolus

Notes

Notes

Publication 2592 (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