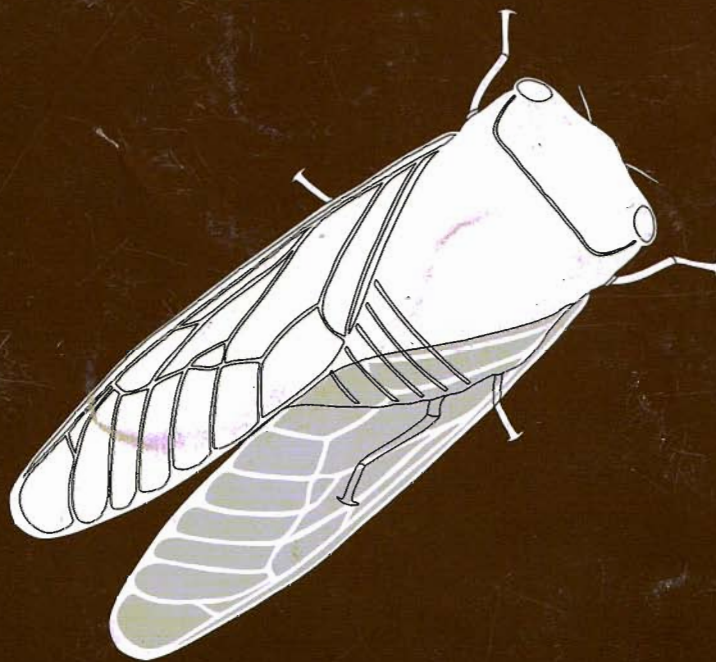


# A GUIDE TO BACKYARD INVERTEBRATES



# A FIELD GUIDE TO BACKYARD INVERTEBRATES

This booklet is packed with information about the creatures featured in the Backyard Invertebrate Cards. Look at the sample page here to find out what you will discover about these fascinating animals.

GREEN PAGES indicate that an animal is an insect.

RED PAGES indicate that an animal is not an insect.

## 1. Classification: Scientific Names

Shows how the organisms are grouped together in categories according to characteristics they share. All of the animals known on Earth are included in the first and largest category, Kingdom. As you move down the list, each category contains fewer and fewer animals, and the animals in each category have more and more characteristics in common.

## 6. A Line Drawing

Illustrates all the main body parts of the animal in a clear and simple outline.

## 9. The Inside Story

Presents a short sketch of what makes this animal special. It might tell more about the animal's life cycle, its place in the ecosystem, its history, or its relationship to humans.

## 2. Common Name

Tells you the most common, everyday name for the animal pictured.

## 3. Life Cycle

Lists information on the type of metamorphosis the animal experiences, if it does experience metamorphosis, or describes unique features of its life cycle.

## 4. Adult Size

Gives the animal's approximate size in both English and metric measurements.

## 5. # of Species

Refers to the approximate number of species in this animal's Family.

## 7. Photo

In full color, portrays the animal in its habitat.

## 8. Diet

Tells what the animal eats at different stages in its life cycle, and may also include information on mouthparts.

## 10. Field Notes

Encourages you to look for the animal outdoors in its natural habitat. Give hints about when and where you would be most likely to spot the creature, and what you might be able to observe about its anatomy or behavior. Safety notes are included.

ANIMALIA			ARTHROPODA			INSECTA			DIPTERA			TABANIDAE					
21	<b>HORSE FLY</b>						LIFECYCLE: COMPLETE METAMORPHOSIS			ADULT SIZE: 1/4 - 1 1/4 in (6 - 30 mm)			# OF SPECIES IN TABANIDAE: 4,000				
																	
<b>DIET</b> The aquatic larvae are carnivorous and prey on other water-dwelling insects, snails, and worms. Although the adult female requires a blood meal for eggs to develop, adults of both sexes typically feed on plant sugars such as the nectar found in flowers.												<b>FIELD NOTES</b> <b>CAUTION:</b> Horseflies can bite. Because breeding requires water, look for the horse fly near slow-moving streams, marshes, and ponds. They are strong fliers, though, and may be found several miles from water. Also check areas where large mammals are present. Hot, sunny, windless days seem to bring them out in abundance.					
<b>Beware!</b> The big female horse fly can inflict a painful bite. Her mouthparts are like tiny jagged saws that cut a hole into your skin. The wound may bleed for some time because the saliva of the female contains chemicals to prevent blood from clotting. The female bites mammals like humans, horses, and deer because she needs the protein in a blood meal for her eggs to develop. For most species of horse flies, the life cycle involves water. The female lays her eggs in jelly-covered masses on plants and rocks that are in or near fresh water. When the larvae hatch, they drop into the water where they may spend one to three years before they emerge and transform into winged adults. They overwinter in the muddy bottoms of ponds and streams.																	

## MORE THINGS TO DO

- ▶ Using the information on classification, sort the animals into categories. Look for the animals' distinguishing characteristics to understand why they belong to different phyla, classes, and orders.
- ▶ Take a field trip to observe one of the animals in its habitat. Collect data on when and where you found it and what it was doing. Make your own illustrations.
- ▶ Use your data and illustrations to create a field guide to the backyard invertebrates in your own neighborhood.
- ▶ Collect one of the animals and bring it indoors for further study. Be sure to provide for all of its needs while it is your guest, and then release it where you found it.

1

## HARLEQUIN BUG

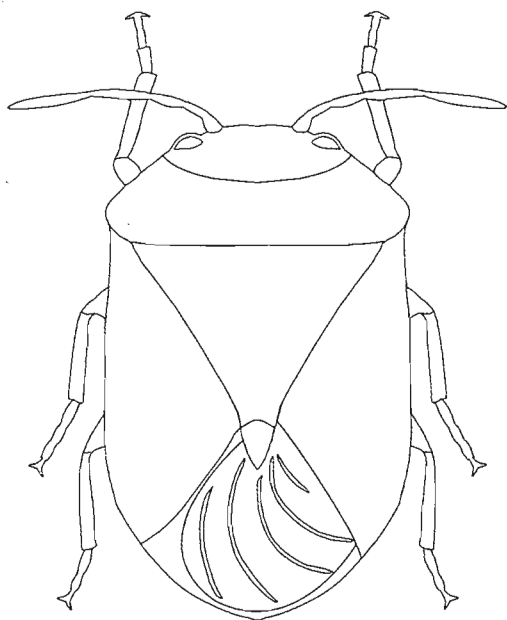
LIFECYCLE: INCOMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN PENTATOMIDAE:

3/16 – 1 in  
(5 – 25 mm)

5,500



## DIET

The harlequin bug is an herbivore and prefers plants in the cabbage family such as cabbage, mustard greens, Brussels sprouts, turnip, collards, and radish. It can do enormous damage to these crops.

This flashy looking pest arrived from Mexico after the Civil War and now inhabits all the southern states. In warmer climates it continues to reproduce and eat crop plants all year long. The harlequin bug literally sucks the life out of a plant. It drinks the plant's juices, and the plant wilts, turns brown, and dies.

It is interesting to note that the first nymphal stages are pale in color. With each molt, the colors get brighter and more distinct. The coloration serves as a warning to predators: the harlequin's nickname is stink bug. It can let off a foul odor when threatened, but the chemicals are not toxic.

## FIELD NOTES

CAUTION:

If handled, harlequin bugs can emit a very unpleasant odor.

Look for harlequin bugs in the southern states, wherever their preferred food crops grow.

# PILLBUG

2

## LIFECYCLE:

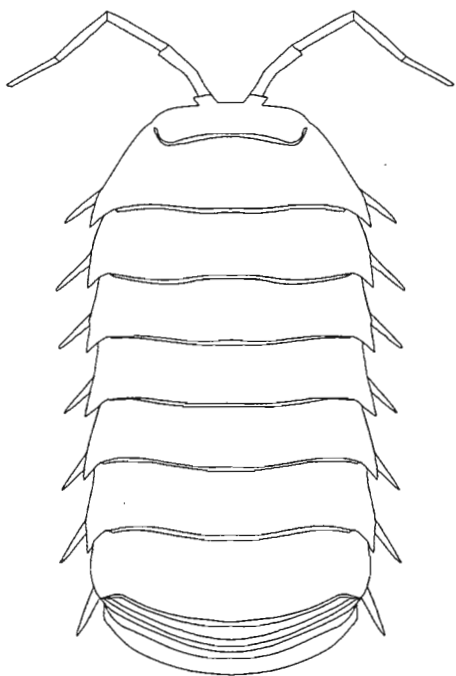
Tiny pillbugs hatch from eggs. They molt 4 - 5 times before reaching their adult size.

## ADULT SIZE:

3/16 - 1 in  
(5 - 25 mm)

## # OF SPECIES IN ARMADILLIDIIDAE:

250



## DIET

Pillbugs eat fungi, decaying plants and animals, and some living plants.

Pillbugs are crustaceans, relatives of the lobster, shrimp, and crab. While most pillbugs are land-dwellers, some are aquatic and may inhabit salt and fresh water.

These little creatures are an important part of nature's recycling crew. They live on dead plant and animal material and return nutrients to the soil.

Pillbugs are also part of the food chain, and are eaten in turn by many small animals. To protect themselves from predators, they roll up into a tight ball. That's how they earned the nickname of roly-poly bug.

## FIELD NOTES

Look for pillbugs in dark, damp places such as under rocks, dead leaves, and rotting logs.

3

## GRASSHOPPER

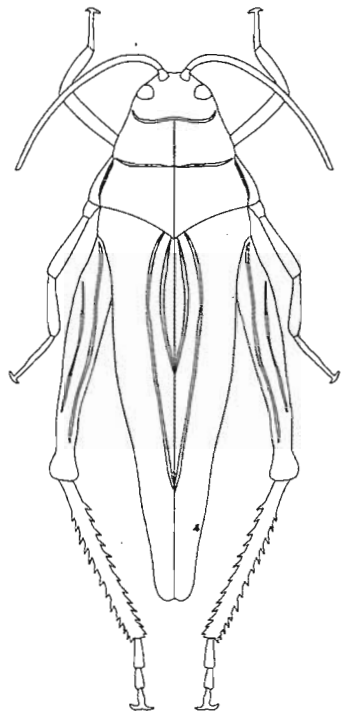
LIFECYCLE: INCOMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN ACRIDIDAE:

3/8 – 3 1/4 in  
(10 – 80 mm)

10,000



## DIET

Both nymphs and adults are big eaters. They may consume as much as 16 times their body weight each day in plant material. Some eat weeds, but many also destroy crop plants.

Equipped with long, muscular hind legs, some grasshoppers can jump as much as 20 times their own body length. By comparison, humans can only jump about five times their own height.

This grasshopper is called short-horned, with antennae about half the length of its body. These are very common and widespread. There are also many other types. The long-horned types, for example, have slender antennae that may be as long as or longer than their bodies.

Male grasshoppers make a chirping sound by rubbing their hind legs against their front wings. They sing mostly to attract mates. It is interesting that grasshoppers don't have ears to act as sound receptors. Instead, they have membranes on their front legs that can feel sound vibrations.

Female grasshoppers have a long, pointed ovipositor at the end of the abdomen. They use this specialized body part to deposit their eggs in soil or in plant tissue.

## FIELD NOTES

If you pick up a grasshopper it may spit "tobacco juice" in your hand. The juice is actually its stomach contents, and is used as defense.

In tall grassy meadows you may find grasshoppers on plant stalks. Try using a sweep net to catch them.

# TICK

4

## LIFECYCLE:

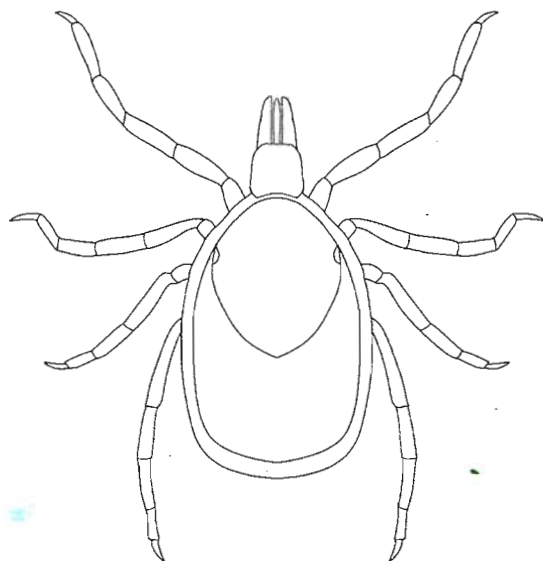
Ticks hatch from eggs. The larval stage has six legs. Nymphs and adults have eight legs.

## ADULT SIZE:

1/16 – 3/8 in  
(2 – 10 mm)

## # OF SPECIES IN IXODIDAE:

650



## DIET

Ticks suck the blood of mammals, birds, and some reptiles.

Ticks are blood-sucking parasites. They are found worldwide, wherever there are other animals that can serve as their hosts.

Since they can not fly or jump, ticks crawl on to the host animal. With their specialized mouthparts, they pierce the skin and suck the animal's blood. A blood-filled tick may balloon out to several times its original size.

After mating, a female tick takes in a blood meal. Then she drops off the host animal and lays her eggs on the ground or in vegetation.

Ticks transmit some very serious diseases to humans and other animals. They can carry Lyme disease, Rocky Mountain spotted fever, tick typhus, African tick fever, and tularemia, to name just a few. Even if they are not carrying disease, a lot of ticks on an animal can weaken it by taking so much of its blood. That might make the animal more prone to disease.

## FIELD NOTES

**CAUTION:** Avoid tick-infested areas. Wear protective clothing with long pants and sleeves if you must be in an area known to harbor ticks. Afterwards check for ticks clinging to your skin or clothing.

Ticks are found in wooded areas, thickets, and meadows. You may also find them attached to an animal such as a dog or cat.

5

## JAPANESE BEETLE

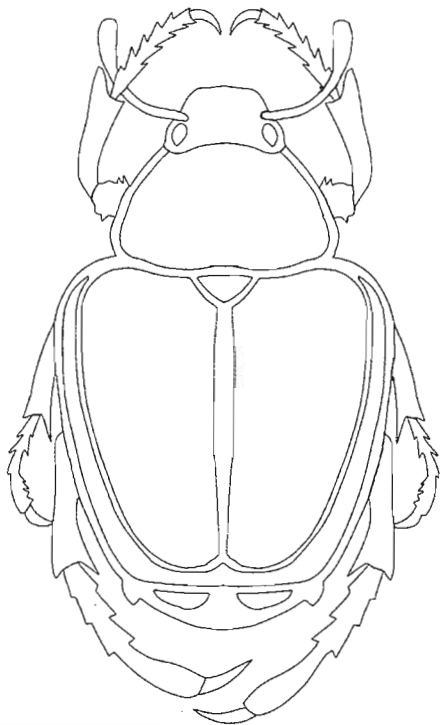
LIFECYCLE: COMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN SCARABAEIDAE:

1/16 – 6 <sup>3</sup>/<sub>4</sub> in  
(2 – 170 mm)

16,500



## DIET

Larvae eat plant roots, especially grasses.

Adults eat over 300 different species of plants. These include many kinds of vegetables, fruits, tree leaves, and flowers.

## FIELD NOTES

To find the larvae, dig down into a section of lawn or meadow after the soil has warmed in spring.

Look for adults from May to August. They are usually feeding above ground on warm sunny days from mid-morning to mid-afternoon.

Look for damage caused by the insects. Plants that have been attacked by Japanese beetles will look chewed and raggedy. Leaves may have a "skeletonized" appearance.

This handsome but unwelcome pest arrived in New Jersey in 1916. Since then, it has spread rapidly throughout most of the states east of the Mississippi.

The Japanese beetle is destructive during two stages in its life cycle: larva and adult. The larvae (also called grubs) hatch from eggs deposited in the soil by the female. They continue to live beneath the soil and grow rapidly, devouring plant roots in lawns and pastures.

In May they emerge as winged adults. Throughout the summer, the adults spend daytime hours consuming above-ground plant parts, including leaves, fruit, and blossoms. At night they return to the soil.

# FIRE ANT

6

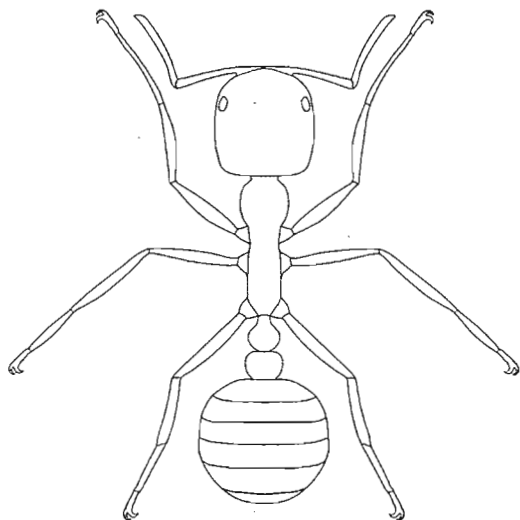
LIFECYCLE: COMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN FORMICIDAE:

1/32 – 3/4 in  
(1 – 20 mm)

9,000



## DIET

Fire ants attack fruit and nut trees, wildflowers, grasses, wheat, corn, soybeans, potatoes, and peanuts. They also cause a serious decline in populations of ground animals such as insects, reptiles, and small mammals.

Fire ants are unwelcome guests in this country. They were accidentally imported in ships from South America, and have spread rapidly through most of the southern states and west into California and Texas. They have no natural enemies here to control their spread.

Victims say their bite burns like fire. They grab onto flesh with their toothed jaws and sting repeatedly, injecting venom that results in painful and itchy blisters that can last for weeks.

Fire ants are social insects. They live together in large mounds that are about 18 inches high (.45m) and that may extend up to 6 feet (1.82m) underground. Colonies typically consist of a queen, workers, and some winged, sexually mature adults. The total population of a mound ranges between 100,000 and 500,000 ants.

Fire ants cause enormous damage both to crops and to natural ecosystems. They are omnivores and devour both plants and animals in their territories.

## FIELD NOTES

**WARNING:** Use extreme caution when observing fire ants. Do not attempt to handle or capture them. Observe their mounds from a safe distance, and use binoculars to scan areas where they are present. Fire ants prefer to build mounds in open sunny areas such as fields, meadows, pastures, and lawns.



7

## FUNNEL WEB WEAVER

## LIFECYCLE:

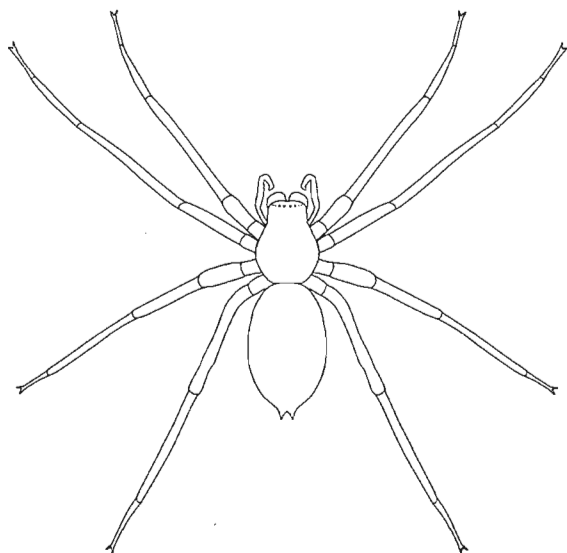
Spiders lay eggs in protective sacs. Spiders molt but do not go through metamorphosis.

## ADULT SIZE:

1/4 – 3/4 in  
(6 – 20 mm)

## # OF SPECIES IN AGELENIDAE:

700



## DIET

Funnel web weaving spiders are predators and feed on a variety of flying and hopping insects such as moths and grasshoppers.

This spider builds a web with a distinctive design. The spider spins the web from a non-sticky kind of silk which it produces from glands in its abdomen. The web looks like a flat sheet with a funnel-shaped hole on one side. Hidden in the hole, the spider waits in ambush.

When an insect hops or flies into the upper section of the web, it bounces off and drops into the funnel below. The spider feels the vibrations, and runs out to grab its victim. Quickly, it injects

venom into the insect to kill it, and pumps digestive juices into the wound. Then it sucks up the liquified body contents.

In spite of having eight eyes, the web weavers have poor eyesight. They depend on unsuspecting flying or hopping insects to drop into their trap.

## FIELD NOTES

This spider often weaves its funnel-shaped web in grassy areas such as fields, meadows, and lawns. You may also find them in leaf litter, and in cool moist spots near foundations or inside buildings.

## MOSQUITO LARVAE

8

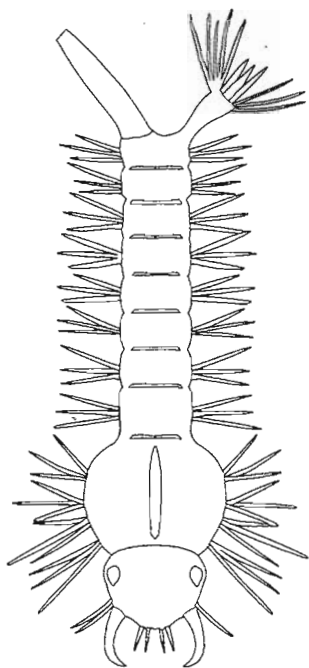
LIFECYCLE: COMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN CULICIDAE:

1/8 – 3/4 in  
(3 – 20 mm)

3,100



## DIET

Adult males and females drink nectar from plants. It is only the female that needs a blood meal in order for her eggs to develop. Larvae have filtering and nibbling mouthparts. Most eat non-living organic matter, but a few are predators.

For over 30 million years, female mosquitoes have been drawing blood from warm-blooded animals. The female has a whole battery of sensors especially adapted to locating her prey. For example, she can sense body heat, gasses that animals give off in breathing, and the chemicals in sweat.

The female mosquito's piercing-sucking mouthparts are well suited to their purpose. First the mosquito stabs into the skin with fine, needle-like mouthparts. Then it squirts saliva into the wound to keep the blood from clotting. (The

saliva is what makes the bite itch later.) Finally, it sucks up blood through another channel in the mouthparts that works like a straw.

After a blood meal, the female lays her eggs in or above standing water, or on soil that will be flooded later. The eggs very quickly hatch out into aquatic larvae called "wrigglers" and then transform into pupae called "tumblers." Both wrigglers and tumblers breathe by extending small tubes through the surface of the water into the air.

## FIELD NOTES

**CAUTION:** Mosquitoes carry a wide range of diseases. Wear protective clothing or use insect repellent when in a mosquito infested area.

Look for larvae and pupae wiggling and tumbling at the surface of stagnant water—anything from a pond to an old tire filled with rain water.

Adults are most active at night.

9

## HONEY BEE

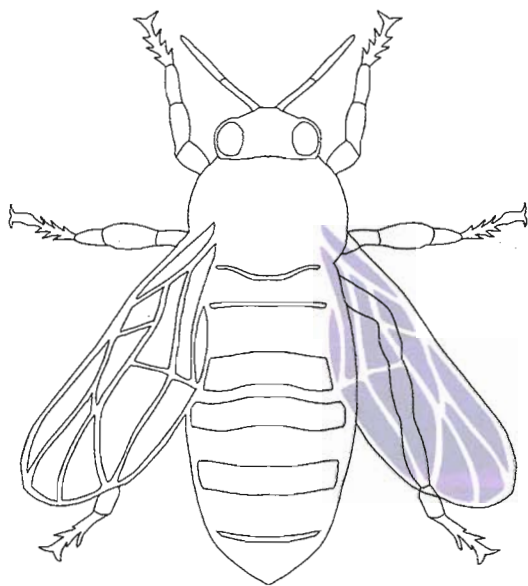
LIFECYCLE: COMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN APIDAE:

1/8 – 1<sup>1/4</sup> in  
(3 – 30 mm)

1,000



## DIET

Worker bees collect nectar and pollen from flowering plants. The nectar mixes with enzymes in the bees' non-digesting stomach and becomes honey. It is placed in storage cells to feed the hive during cold weather.

Honey bees are social insects. They live and work together in a complex colony composed of three different groups called castes.

The queen and drones (males) make up the reproductive caste. The queen is the largest bee in the hive, and the only sexually developed female. She may lay as many as 3,000 eggs in one day. The drones' only job is to fertilize the queen.

The smallest bees are the female workers. There

may be 50,000 to 60,000 workers in a single hive.

At different stages in their lives, worker bees do different jobs. Newly emerged worker bees secrete wax from their bodies to build and repair cells in the hive. When wax production stops, the workers become guard bees at the entrance to the hive. Still later, they become scout bees searching for food, and finally become field bees who bring nectar and pollen back to feed the hive.

## FIELD NOTES

**CAUTION:** Worker bees can sting. Observe them from a safe distance. Do not try to catch or handle them.

Look for bees collecting nectar and pollen from flowering plants. They are especially active on warm sunny days.

Listen for their characteristic buzz. The sound comes from their rapidly beating wings, about 11,400 wing beats per minute.

## CLOUDLESS SULPHUR BUTTERFLY

10

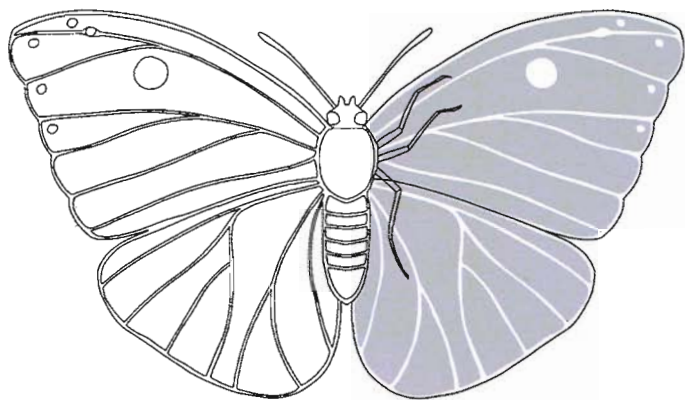
LIFECYCLE: COMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN PIERIDAE:

3/4 – 2 3/4 in  
(20 – 70 mm)

1,200



## DIET

Larvae use chewing mouthparts to eat leaves of bean, pea, and clover plants.

Adults have sucking mouthparts to sip nectar from blossoms.

Members of the order Lepidoptera all go through complete metamorphosis. They begin their life cycle as small, inconspicuous eggs, often placed on the food they will eat when they hatch.

In the larval stage, the cloudless sulphur caterpillar is a pale greenish yellow with black stripes and dots. It has an unusual habit: it constructs a protective daytime shelter by wrapping silk loosely around a leaf of its host plant.

Although the caterpillar is a big eater, it is not considered a serious pest.

Its pupa is a curious shape, long and pointed with a bump in the middle. It is colorful, and may be pink or green with yellow or green stripes.

Like all adult butterflies, this one has four scale-covered wings and coiled, sucking mouthparts. Butterflies have excellent vision which they use to locate food and mates. Most have scent receptors on the antennae, and taste receptors on their feet.

## FIELD NOTES

Butterflies are active on warm sunny days. They prefer open areas with flowering plants.

Use a net to catch them. Avoid touching the wings because it is easy to damage or rub off the delicate scales that cover them.



# SLUG

## LIFECYCLE:

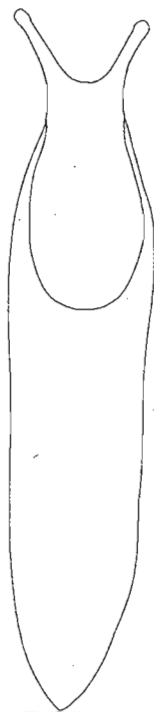
Slugs lay from 20 to 100 eggs at a time, several times a year. Miniature slugs hatch out.

## ADULT SIZE:

up to 10 in (250 mm)

## # OF SPECIES IN ARIONIDAE:

39



## DIET

Slugs feed on all kinds of fruits and plants, and have a preference for tender young seedlings.

## FIELD NOTES

Slugs are most active at night, especially when the ground is moist.

Look for a slimy trail of mucus to track their movements. During the day they hide in damp places such as under rocks, logs, or mulch.

Slugs are like naked snails. They have the same soft body, but no protective shell. Slugs and snails glide along on their flat, muscular stomachs. The name gastropod literally means "stomach foot."

Slugs have rasping tongues that work like a file. They use their tongues to scrape off bits of food and break it down into small pieces.

Slugs are pests in the garden and can cause considerable damage if they are numerous.

# COCKROACH

12

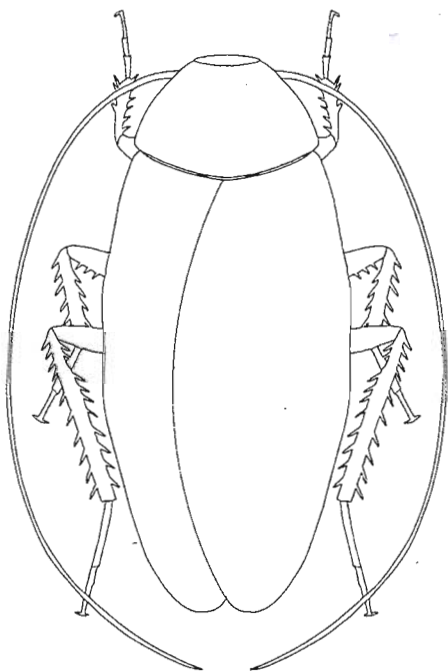
LIFECYCLE: INCOMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN BLATTIDAE:

3/4 – 1<sup>3/4</sup> in  
(20 – 45 mm)

600



## DIET

Cockroaches are omnivores and will readily eat all kinds of plant and animal materials. Although they can survive for up to a month without food, they will die within a week without water.

In spite of their bad reputation, cockroaches do have some good qualities. Most cockroach species live outdoors. There they are scavengers and play an important role in their ecosystems. Worldwide, less than 1% are indoor species and considered pests.

Cockroaches are survivors. They evolved over 350 million years ago and inhabit most regions of the globe. They have developed resistance to many powerful pesticides, and so are hard to control with chemical warfare.

True, the indoor cockroaches have some pretty disgusting habits. They invade our food supply and walk all over it with legs that might have just walked through sewage. They can make a meal of just about anything—meats, vegetables, dandruff, blood, or toenails. And they leave behind their feces, their eggs cases, and a foul smell. Some people are even allergic to cockroach dust particles in the air.

## FIELD NOTES

Cockroaches are nocturnal. They are active at night when they go out in search of food, water, and mates. They spend the daylight hours hidden in cracks, basements, sewers, closets, television sets—just about anywhere dark and above freezing temperatures.

13

## MILLIPEDE

## LIFECYCLE:

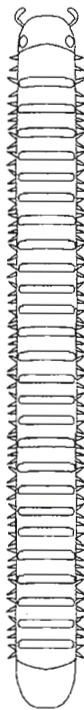
Females lay eggs in a nest and guard them until they hatch. The young grow and molt, adding more body segments and more legs with each molt.

## ADULT SIZE:

1/2 – 11 in  
12 – 280 mm

## # OF SPECIES IN SPIROSTREPTIDAE:

800



## DIET

Millipedes are scavengers and eat dead and decaying plant matter.

Millipedes move with a slow and graceful rippling motion. Two pairs of legs grow from each body segment, so a really big millipede may have hundreds of legs, but never thousands as the name implies.

Millipedes are peaceful animals, herbivores for the most part. They are preyed upon by insects, birds, and toads. They are too slow to escape on foot so when they are threatened, millipedes coil up into a tight spiral. Some may also let off a strong, unpleasant odor to discourage predators.

## FIELD NOTES

North American species of millipedes are harmless, and can be picked up and handled carefully. Look for them in dark, damp places with lots of dead vegetation, such as leaf piles, compost heaps, or old wood piles. In cold weather they may seek shelter in a damp basement.

To watch their amazing legs in action, lift a millipede gently onto a piece of clean paper or put one in a clear container.

## LADYBIRD BEETLE LARVA

14

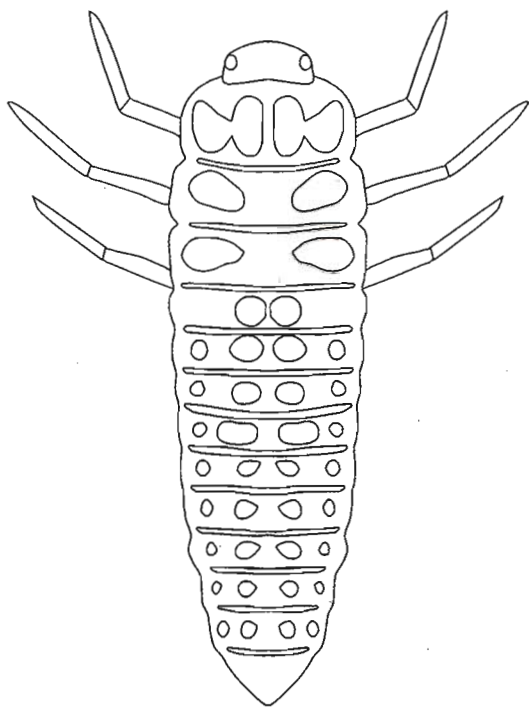
LIFECYCLE: COMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN COCCINELLIDAE:

1/32 – 5/8 in  
(1 – 15 mm)

5,000



## DIET

Both larvae and adults are predators. They eat soft-bodied insects such as aphids, mites, scale insects, and mealybugs.

The brightly colored little ladybird beetle is a welcome sight to gardeners everywhere. Ladybird beetles have big appetites and devour huge numbers of insect pests. They are so good at their job that gardening supply companies sell them as natural pest controls.

Ladybird beetles come in a wide variety of colors and spot patterns. Depending on the species, they may be yellow, orange, or red with black spots, or black with red or yellow spots.

## FIELD NOTES

In warm weather, look for both adult and larval ladybird beetles on plants in woods, meadows, gardens, and orchards.

Ladybird beetles overwinter as adults, often in large groups. You may find them under leaves or in the cracks of trees outdoors. Some may also find their way into buildings and congregate around windows and ceilings.

When disturbed, the ladybird beetle may release a smelly but harmless liquid.



15

## EARTHWORM

## LIFECYCLE:

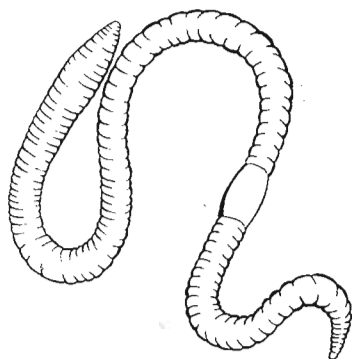
Eggs develop inside a cocoon, and hatch out as tiny worms.

## ADULT SIZE:

SIZE  $3/4$  to  $5^{3/4}$  in  
(2-15 cm)

## # OF SPECIES IN LUMBRICIDAE:

220



## DIET

Earthworms eat dead organic matter and soil.

An earthworm's body is made up of as many as 100 segments or rings. Each segment has pairs of bristles called setae that help the worm move forward. It breathes through its mucous covered skin, and must stay moist in order to breathe.

Earthworms are hermaphrodites (animals with both male and female reproductive organs). During mating, pairs exchange eggs and sperm.

Earthworms are beneficial animals. Their long underground burrows provide pathways for both air and water to reach plant roots. Worms break down dead plant matter and excrete it as castings. The castings are rich in nutrients and do much to improve the soil.

Worms are an important part of the food chain. They are eaten by many predators such as small mammals, fish, reptiles, and birds. Their bodies are about 70% protein, so they make a very nutritious meal.

## FIELD NOTES

Earthworms must live in moist, dark places. Look for them in soil, in compost piles, under leaves, and on a damp lawn at night.

Earthworms emerge from their burrows on damp or rainy nights. The moist conditions make it easier for them to disperse and find mates. However, they are in danger whenever they are on the surface. They are easy prey. They may also drown in puddles or dry up in the hot sun.

# FIELD CRICKET

16

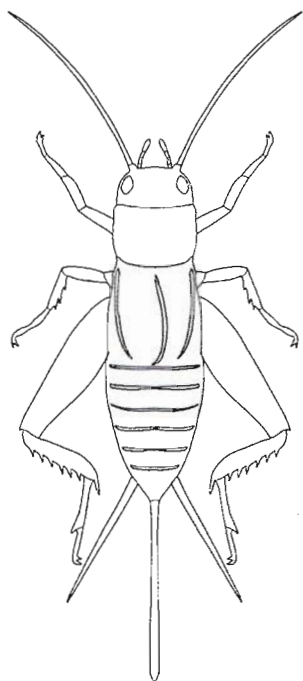
LIFECYCLE: INCOMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN GRYLLIDAE:

1/5 – 1 in  
(4.5 – 24 mm)

800



## DIET

Depending on the species, crickets eat both plants and animals. For example, they may eat crop plants (and cause damage to human food supplies), and they may also eat other insects.

Crickets are the cheerful "singers" of the insect world. With over 2,300 species of true crickets, that makes for an amazing variety of buzzes, chirps, and trills.

In most species it is the male cricket that produces sound. He does this by scraping his front wings together very rapidly. Most crickets sing to attract mates, but some also make sounds to defend territories or to signal danger.

## FIELD NOTES

Crickets are very common insects, found in many different types of habitats. Listen for their songs, and try to locate them from the direction of the sound. You may find crickets in fields and lawns, on trees and bushes, under rocks or logs, in loose soil, and even in your damp basement.

Try different times of day to locate crickets. Some kinds of crickets are active during the day (diurnal). Others are active at night (nocturnal).

17

## TENT CATERPILLAR MOTH

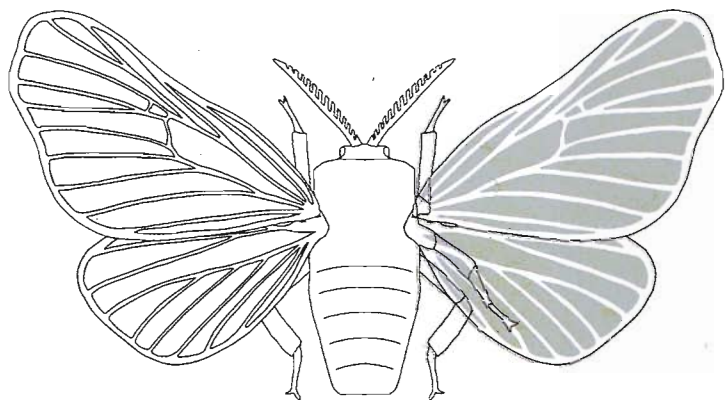
LIFECYCLE: COMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN LASIOCAMPIDAE:

1 – 3 <sup>3</sup>/<sub>4</sub> in (wingspan)  
(25 – 95 mm)

2,000



## DIET

Adults do not eat. Larvae eat tree leaves of different species, depending on their geographical location. In the east, favorite trees include cherry and apple. In the west, favorites are alder, cottonwood, birch, balsam and aspen.

Soon after they hatch, the caterpillar colony begins working together to spin a large silky web, most often in the fork of a tree. The tough web provides protection from predators.

The tree is the caterpillars' food source too. A large colony of caterpillars can completely strip a tree of its leaves in one season. Although this may weaken the tree temporarily, it does not usually kill it.

The caterpillars seem to have a daily schedule. Morning and evening they work on the nest, adding more clean layers as the summer goes on. Several times a day they leave the tent to feed. They follow web trails left by the caterpillars going out before them to find the best food sources.

After five molts the caterpillar pupates inside a silken cocoon. A stubby brown moth emerges. It has no working mouthparts, and must mate quickly, before its energy reserves run out.

## FIELD NOTES

In spring, look for their telltale webs in the forks of their favorite trees.

Depending on what grows in their geographical location, larvae may eat the leaves of several different species of trees.

# HOUSE CENTIPEDE

18

## LIFECYCLE:

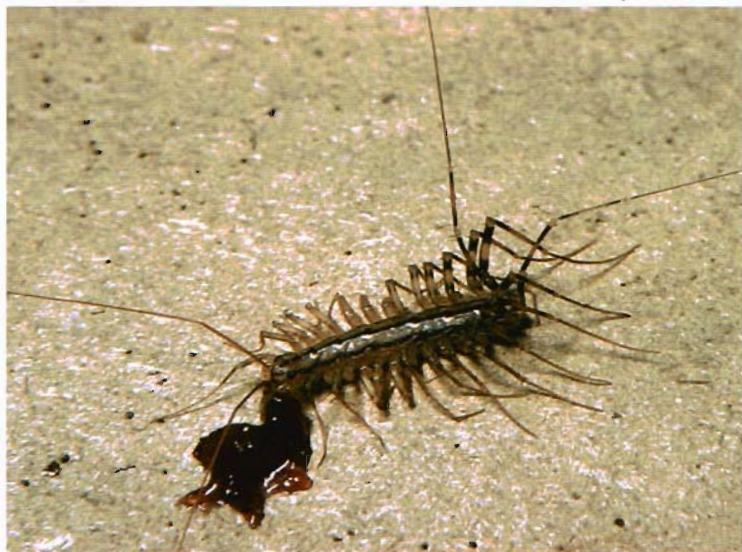
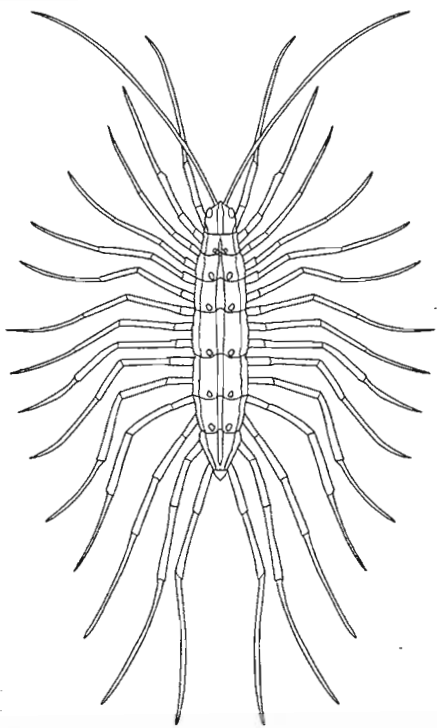
Most centipedes lay eggs, but some are born live. They molt in order to grow, but do not undergo metamorphosis.

## ADULT SIZE:

3/8 – 2 in  
(10 – 50 mm)

## # OF SPECIES IN SCUTIGERIDAE:

150



## DIET

Centipedes are active predators and feed on small worms, insects, spiders, and larvae.

These are fast-moving hunters with fangs. They kill or paralyze their prey with a poisonous bite, and then chew them up with their strong jaws. Centipedes eat a wide variety of insects and their larvae, among them some household pests, so they are considered beneficial.

In this family (Scutigerae), adults have 15 pairs of legs. Other centipedes may have as many as 29 or more pairs of legs. Each pair of legs grows from one body segment.

## FIELD NOTES

**CAUTION:** Although a centipede's bite is harmless to humans, it may be painful. Avoid handling them.

Most centipedes live outdoors in dark protected places such as in soil, in rotting wood, and under rocks. Indoors, look for them in damp areas such as the basement or the bathroom. They are common all over the world.

19

## LEAFHOPPER

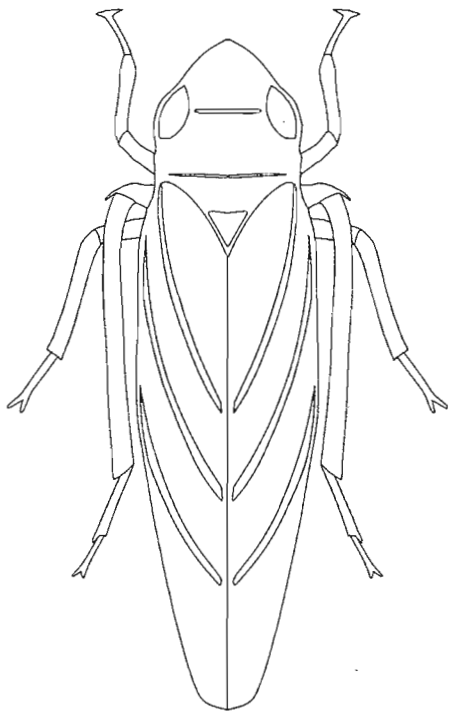
LIFECYCLE: INCOMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN CICADELLIDAE:

1/8 – 3/4 in  
(3 – 20 mm)

16,000



## DIET

The leafhopper uses its piercing-sucking mouthparts to drink plant sap. It feeds on a wide variety of plants, such as grasses, weeds, flowering plants, and tree leaves.

Leafhoppers have a remarkably long history of survival. Fossils tell us that they have existed for about 125 million years. Today this ancient example of insect life is found worldwide, in any habitat that supports plants.

Some species of leafhoppers (such as the potato leafhopper) are agricultural pests. They suck the sap out of plants, causing them to weaken and wilt, and in extreme cases, to die. Leafhoppers are also responsible for transmitting some plant diseases, especially viruses.

Leafhoppers excrete a sticky, sweet liquid called "honeydew" as they feed on sap.

## FIELD NOTES

Because of their bright colors, leafhoppers are easy to spot. Look for them in grassy areas, fields, and meadows.

They can hop, run, and fly, so they may be difficult to catch. Try using a net.

## CICADA

20

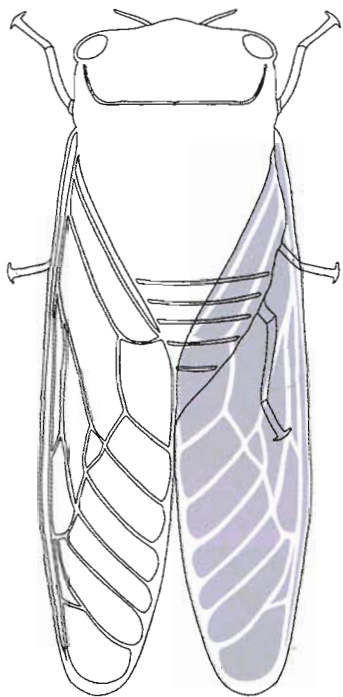
LIFECYCLE: INCOMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN CICADIDAE:

1 – 2 <sup>1</sup>/<sub>4</sub> in  
(23 – 55 mm)

2,500



## DIET

Cicadas have piercing-sucking mouthparts. Nymphs feed underground on sap in roots. Adults feed on sap in the upper parts of trees.

The metallic buzz of thousands of cicadas can be nearly deafening on a hot summer's day. Poets say it is a joyful noise, celebrating the insects' emergence into daylight after years spent underground. But scientists know that it is a mating call.

Only the males call, and each species has its own distinctive call pattern. The male's shrill song is produced by a pair of vibrating membranes (called tymbals) located in the first segment of the abdomen.

After mating, the female cuts a slit into the tip of a branch and lays her eggs. When the eggs hatch, the tiny nymphs drop to the ground and dig themselves into the soil. Here they will spend long, dark years. Depending on the species, the nymphs may live underground for 2, 5, 13, or even 17 years. No wonder there is so much singing when they finally emerge!

## FIELD NOTES

In late spring or early summer, look for the cicadas' molted exoskeletons on lower portions of trees and nearby bushes or buildings. This would be the insect's last molt—from nymph to adult. From now on the winged adult spends its time high up in a shade tree where it is difficult to see. Follow their songs, and try using binoculars to get a better look.

21

## HORSE FLY

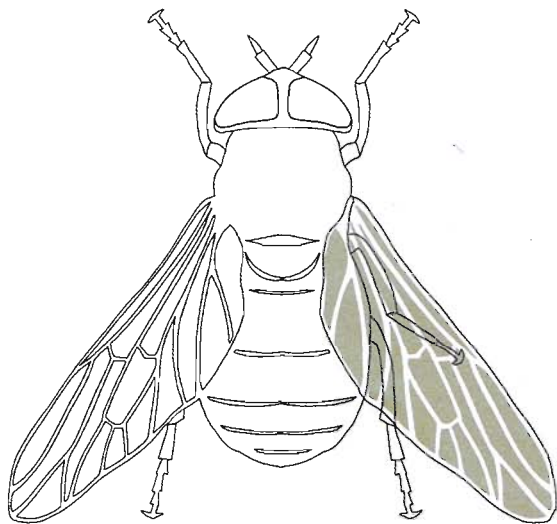
LIFECYCLE: COMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN TABANIDAE:

1/4 – 1<sup>1/4</sup> in  
(6 – 32 mm)

4,000



## DIET

The aquatic larvae are carnivorous and prey on other water-dwelling insects, snails, and worms. Although the adult female requires a blood meal for eggs to develop, adults (of both sexes) typically feed on plant sugars such as the nectar found in flowers.

Beware! The big female horse fly can inflict a painful bite. Her mouthparts are like tiny jagged saws that cut a hole into your skin. The wound may bleed for some time because the saliva of the female contains chemicals to prevent blood from clotting. The female bites mammals (like humans, horses, and deer) because she needs the protein in a blood meal for her eggs to develop.

For most species of horse flies, the life cycle involves water. The female lays her eggs in jelly-covered masses on plants and rocks in or near wetlands, salt marshes, ponds, or streams. When the larvae hatch, they drop into the water where they may spend one to three years before they pupate and then transform into winged adults. They overwinter in moist areas in their larval habitats, such as muddy bottoms of ponds and streams.

## FIELD NOTES

CAUTION: Horse flies can bite.

Because breeding requires water, look for horse flies near slow-moving streams, marshes, and ponds. They are strong flyers, though, and may be found several miles from water. Also check areas where large mammals are present.

Hot, sunny, windless days seem to bring them out in abundance.

## PEA APHID

22

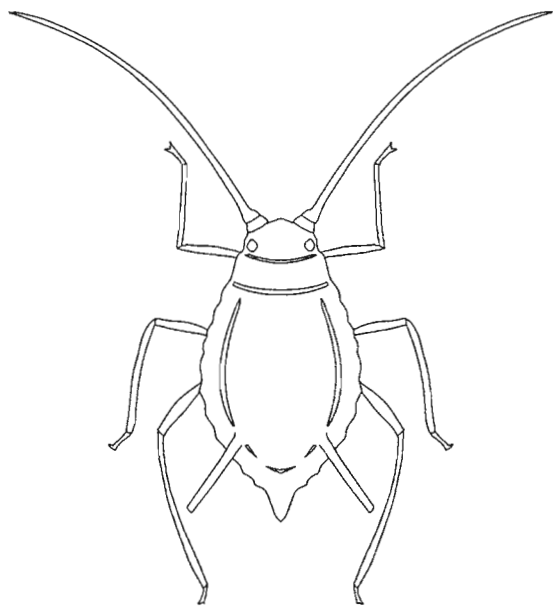
LIFECYCLE: INCOMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN APHIDIDAE:

1/32 – 5/16 in  
(1 – 8 mm)

2,250



## DIET

Aphids suck juices from a wide variety of plants.

Aphids are tiny, but when present in great numbers—and they usually are—they can suck the life out of a plant. They have an amazing rate of reproduction, and can soon overrun a garden. Females can even reproduce without mating, and give birth to live young (not eggs). Basically, aphids take shortcuts in the life cycle which quickly results in a huge population.

Aphids give off a sticky, sweet liquid called “honeydew” which many other insects lap up

greedily. Ants in particular find honeydew irresistible. Some species of ants will develop a mutually beneficial relationship with aphids. The ants stroke the aphids gently to encourage them to excrete their honeydew. In return, the ants protect the colony from predators such as ladybugs and lacewings.

## FIELD NOTES

Look for clusters of aphids at the tender growing tips of plants. You may be able to observe nymphs of several different sizes, as well as adults.

Try to see evidence of a predator/prey relationship.

If ants are farming the colony, watch for the honeydew milking behavior.



23

## SILVERFISH

LIFECYCLE: Ametabolous, or lacking metamorphosis

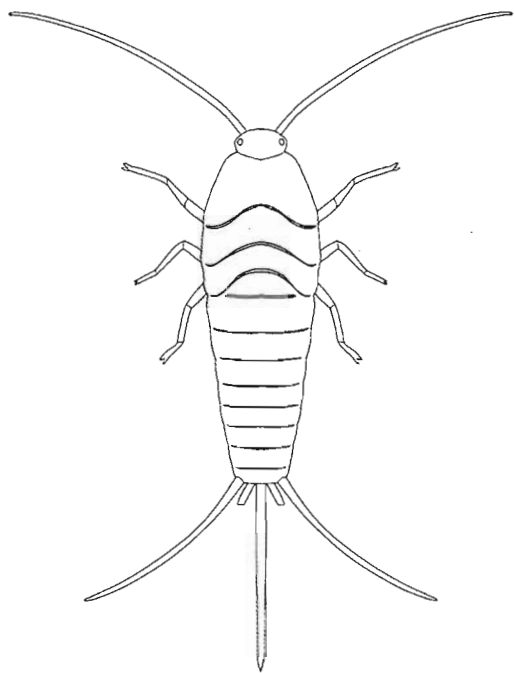
ADULT SIZE:

# OF SPECIES IN LEPISMATIDAE:

After hatching from an egg, it grows and molts throughout its lifetime, even after reaching sexual maturity. It does not change form.

5/16 – 3/4 in  
(8 – 20 mm)

190



## DIET

Silverfish eat a varied diet which includes algae, lichens, and vegetable matter high in starch content. Indoors they may feed on cloth, wallpaper paste, book bindings, cardboard, and other paper products.

## FIELD NOTES

Most silverfish are nocturnal. Outdoors they spend the day hidden under stones, leaves, or logs. Those that inhabit buildings such as homes, bakeries, or bookstores may hide in basements and attics.

Silverfish are primitive insects. They existed even before dinosaurs. They are known as "bristletails" because of the fringed, three-pronged tails at the end of the abdomen. Although wingless, they are fast movers on the ground.

Silverfish engage in an interesting courtship. The male hangs a silken thread across the female's path, and places a packet of sperm beneath the thread. When the female walks under the thread, she comes in contact with the sperm packet. She picks up the packet with her genital opening and the sperm enter her body and fertilize her. Then she releases the empty sperm packet and eats it.

# FIREFLY

24

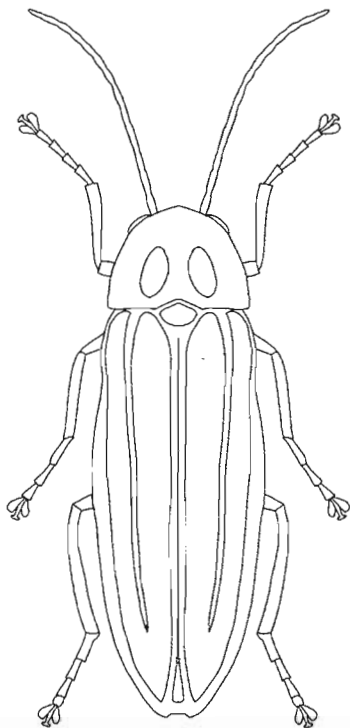
LIFECYCLE: COMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN LAMPYRIDAE:

3/16 – 1<sup>1/4</sup> in  
(5 – 30mm)

2,000



## DIET

Firefly larvae are predators. They consume slugs, snails, and earthworms. In adults, diet varies according to species. Some drink nectar from plants and some eat other insects—even other fireflies.

## FIELD NOTES

Fireflies are nocturnal. Look for their flashing lights on warm summer nights. Depending on the species, they may begin to signal at dusk or after it is completely dark. They often appear over lawns and meadows, and close to water. Some prefer the edges of woodlands.

Try to figure out the flash pattern. How long is the flash? How long between flashes? How many flashes in a signal?

These well-loved insects light up the summer night with their twinkling glow. Most adult fireflies (plus all eggs and larvae) have the ability to produce light. They have what is called bioluminescence, meaning that they can make light from chemical reactions in their bodies.

There is a purpose in the flashing lights sent out by the adults. Each species of firefly has its own flash pattern. That is how the males and females of the same species recognize each other. It is like a secret password.

For each species, the blips of light are of a certain length and brightness. The male flashes, and the female of the same species responds. Then the male finds his way to the female, guided by her continued flash pattern.

25

## HICKORY HORNED DEVIL

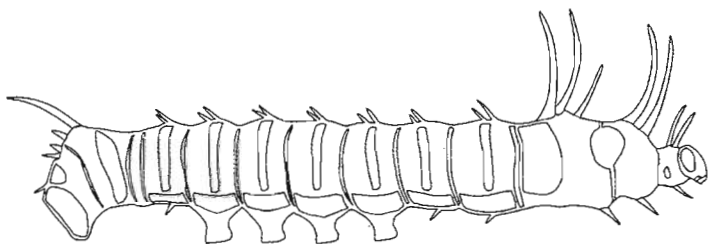
LIFECYCLE: COMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN SATURNIIDAE:

2 – 12 in (wingspan)  
(50 – 300 mm)

1,200



## DIET

With its strong chewing mouthparts, the caterpillar eats leaves of hickory, ash, butternut, walnut, and pecan trees. It will also eat lilac, sumac, persimmon, and sweet gum leaves. The adult does not have working mouthparts and does not eat.

Do you think that this caterpillar is well-named? Most people would agree that with its long curving horns, bristling spikes, and wild color scheme, it is a fearsome sight. For a caterpillar, it is also very large. Scary as it looks, the hickory horned devil is harmless.

After hatching out in early summer, the caterpillar spends about a month eating and growing to its enormous size. Then it drops to the ground and digs into the soil. There it pupates and spends the winter.

Next spring, a surprisingly beautiful large moth emerges from the pupa. Even its name has changed. The adult form is known as the royal walnut moth or the regal moth.

The adults mate on the second night after they emerge, and the female starts laying eggs by the next evening. The adults soon die, but in about a week the eggs hatch and the cycle begins again.

## FIELD NOTES

Look for the caterpillars in forested areas, munching on the leaves of their favorite trees.

The adults have a brief life span and are more difficult to observe.

# DRAGONFLY

26

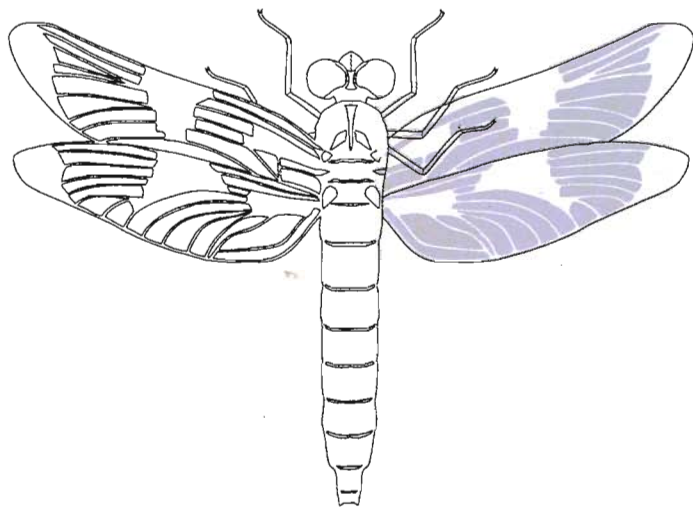
LIFECYCLE: INCOMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN LIBELLULIDAE:

3/4 – 3<sup>3/4</sup> in  
(20 – 95 mm)

1,300



## DIET

Nymphs eat small fish, other insects, and tadpoles. Adults prey upon flying insects such as mosquitoes, flies, and midges.

Dragonflies are aeronautical wonders, able to dart and hover, and fly both backward and forward. Their four long wings are powered by strong muscles in the thorax.

The dragonfly is also a fierce predator, both as an aquatic nymph and as a flying adult. The nymphs have an unusual, hinged lower lip. They lie in wait in the water, and then burst forth with amazing speed and shoot out their lower lip to grab prey.

The flying adults have very good vision. When they spot their prey, they speedily give chase. With their long legs positioned like a spiny basket, they trap the prey in mid-air, and devour it alive.

## FIELD NOTES

Look for dragonflies near still or slow-moving water, such as ponds, lakes, streams, and swamps. They are most active in the middle of the day.

Since they are large insects, they are easier to observe than most. You may be able to trace their patterns of flight, watch them catch prey, and notice males patrolling their territories.

27

## PRAYING MANTIS

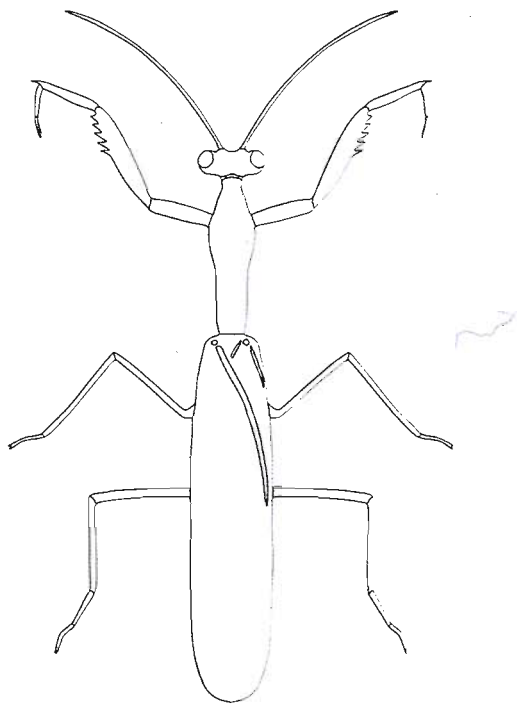
LIFECYCLE: INCOMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN MANTIDAE:

3/4 – 6 in  
(20 – 150 mm)

1,400



## DIET

Praying mantids eat other insects and spiders. They are not choosy, and eat both harmful and beneficial types.

A voracious praying mantis is a stealthy predator. Well camouflaged, it sits almost motionless, waiting for its prey. Its strong front legs are folded, as if in prayer.

If the slightest movement catches its eye, the mantis can turn its head to focus in on it. Then with lightning speed the mantis attacks. It grabs the unsuspecting victim in its powerful front legs. With its strong chewing mouthparts, it devours its prey alive.

## FIELD NOTES

Look for mantids perched on vegetation such as grasses and flower stalks in fields and meadows and on branches or leaves in woodlands. Because they are well camouflaged and sit very still, they are difficult to see even when they are right in front of you.

In fall and winter, look for their egg cases. They are tan and foamy looking, about one inch long. You'll find them attached to the stems of grasses and plants.

# BESS BEETLE GRUB

28

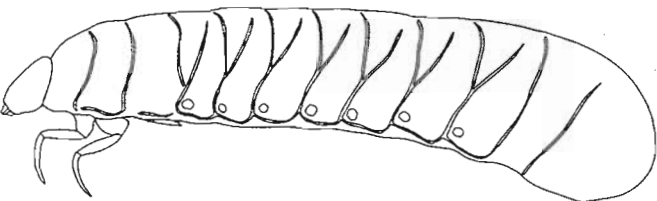
LIFECYCLE: COMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN PASSALIDAE:

3/8 – 3 3/4 in  
(10 – 95 mm)

500



## DIET

Bess beetles take in wood but can't digest it. They excrete the chewed up wood, and a fungus grows on the feces. Then they eat the feces-grown fungus for nourishment. Adults feed the grubs on a mushy mixture of chewed wood, feces, and fungus.

## FIELD NOTES

Bess beetles live in galleries which they carve into dead wood, especially oak. Look for them in stumps and fallen logs. You may be able to find both larvae and adults.

Listen for their squeaking noises within the galleries. If disturbed, they may sound a loud warning call.

Bess beetles are not truly social insects, and although many beetles may live together in a colony, there is no queen, no castes (or classes), and no division of labor. But they do have some interesting social behaviors. For instance, bess beetles live together in pairs within a colony. Both males and females tend their eggs, larvae (called grubs), and pupae. Parental care, which includes protecting and feeding the young, may last for over a year.

Bess beetles also communicate with a series of loud squeaks and clicks. Grubs stroke their very short front legs against ridges on their abdomens to produce sound. Adults make noise by rubbing their forewings against their abdomens. Some of these are mating calls. Others are warning calls to the colony.

29

## VELVET MITE

## LIFECYCLE:

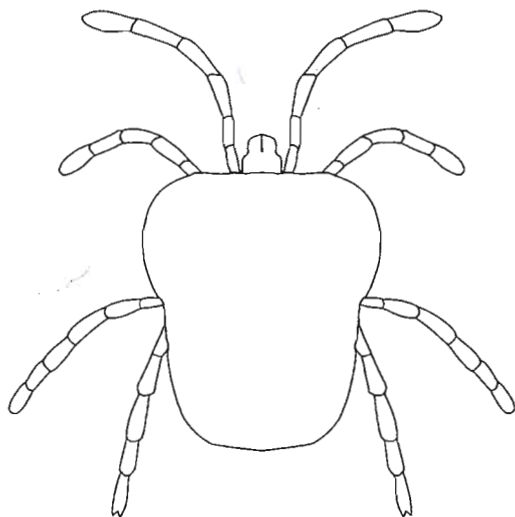
Mites hatch from eggs. The first larval form has six legs, but the adults have eight.

## ADULT SIZE:

1/16 – 3/8 in  
(2 – 10 mm)

## # OF SPECIES IN TROMBIDIIDAE:

250



## DIET

Some mites suck plant juices and can be agricultural pests. Some are parasites and suck the blood of birds and mammals. Some feed on skin and hair, and can cause severe itching if they burrow under the skin.

## FIELD NOTES

Because most mites are very tiny, they are hard to find and observe. Look for them in a wide variety of habitats: in soil and water, on plants, and on many kinds of animals, including humans.

There are thousands of different kinds of mites, inhabiting nearly all corners of the globe. Mites are real survivors, and have adapted to some pretty harsh environments. In addition to living in forest soil and in pond water, some species can be found thriving in the desert, in polar regions, and even in hot springs.

Although some mites are harmless, many are destructive of crops, stored food, and other plant material. Still others are parasites: they live on other animals and cause them harm. They may weaken the host animal, cause it great discomfort, or transmit diseases from one animal to another.

# SCORPION

30

## LIFECYCLE:

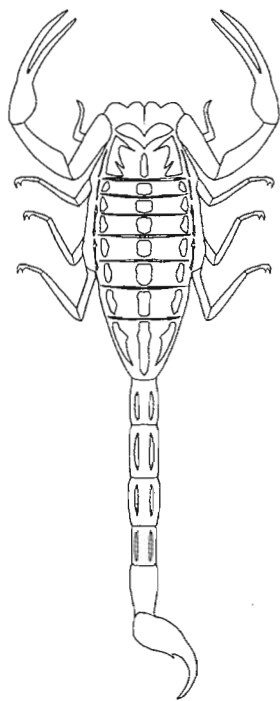
Scorpions hatch from eggs while still inside the mother's body. Afterwards, they grow and molt.

## ADULT SIZE:

5/16 – 4<sup>3/4</sup> in  
(8 – 120mm)

## # OF SPECIES IN BUTHIDAE:

520



## DIET

Scorpions are venomous predators that eat insects, spiders, centipedes, and other scorpions. Some very large scorpions will also prey upon lizards, mice, and snakes.

With its long slender body and menacing tail, the scorpion has a fearsome look, and its venom can pack a powerful punch. Barbed stingers located at the tip of the tail inject the venom. Most scorpion bites are not fatal to humans, but they can be quite painful.

Scorpions engage in a complex mating dance. The male and female join their front appendages and step back and forth, locked together. The male then drops a sperm case and pulls the female over it. The sperm is taken up by the female, and the eggs are fertilized. The young scorpions develop within the female's body and are born live, fully formed, several months to a year later. They crawl up onto the mother's back where they ride, safe from predators, until after their first molt.

## FIELD NOTES

**CAUTION:** Scorpions can inflict a painful sting. Do not try to handle or capture them. One species of scorpion in the U.S. has venom strong enough to cause serious effects in humans. These include pain, numbness, and swelling; problems in breathing; muscle spasms and convulsions.

Scorpions are secretive and nocturnal. They hide under rocks or in burrows during the day and come out to hunt at night. They prefer warm climates, and are found all over the world.



31

## ZEBRA SPIDER

## LIFECYCLE:

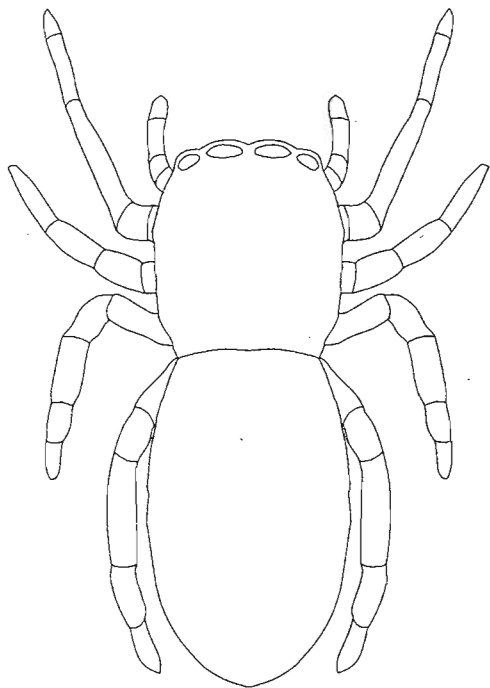
Zebra spiders lay eggs. The female guards the young spiderlings until they have gone through their second molt.

## ADULT SIZE:

1/16 – 5/8 in  
(2 – 16 mm)

## # OF SPECIES IN SALTICIDAE:

5,000



## DIET

All spiders are predators. Zebra spiders prey upon a wide variety of insects.

This spider is a member of the jumping spider family. It is an active hunter and, for a spider, it has very good eyesight. It spots its prey visually and then pounces on it, sometimes from a fair distance. Some jumping spiders can leap more than 50 times their own body length. The spider's good vision allows it to judge the distance accurately.

Jumping spiders also rely on their good vision to find mates. Some are very colorful or marked

with distinctive stripes or spots. The males engage in complicated courtship dances to win over the females.

The zebra spider is not a web spinner, but like all spiders, it can make silk. Sometimes it attaches itself to a silky drop line and parachutes down on it to reach its prey.

## FIELD NOTES

Zebra spiders prefer warm sunny spots. Look for them in many different habitats such as in meadows or gardens, and in wooded areas.

Notice their four big "head-light" eyes and four smaller eyes.

# EARWIG

32

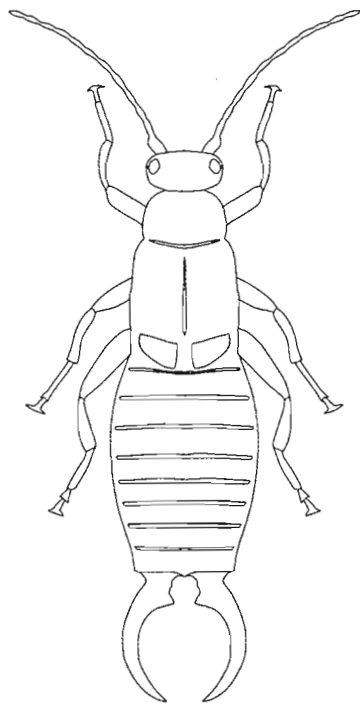
LIFECYCLE: INCOMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN FORFICULIDAE:

1/2 – 1 in  
(12 – 25 mm)

450



## DIET

Many earwigs feed on growing vegetation, such as moss, lichens, fungi, flowers, vegetables, and fruits. Some feed on decomposing vegetation such as rotting logs or leaf litter. Others are carnivores and eat insects and spiders, both dead and alive.

## FIELD NOTES

**CAUTION:** Earwigs can give a small, harmless pinch with the forceps at end of their abdomen. If handled, they may give off a bad smelling liquid from their scent glands.

Look for earwigs in damp, cool places such as a basement, a mulch or compost pile, under logs, and under tree bark. You may also find them feeding on flowers or leafy plants in the garden. They are most active at night.

First of all, they don't crawl into your ears or into your wigs either. That is just an old superstition. Earwigs are pretty harmless, but they do have a rather fearsome look.

The female earwig is a protective mother, somewhat unusual in the insect world. In the fall she lays 20 to 50 eggs in a small chamber which she digs in the soil. She rotates the eggs and keeps them clean. When they hatch, she watches over the nymphs until their first molt. After that, the nymphs leave the nest and go off on their own.

Earwigs scoot about very quickly on the ground. Most have wings, but they rarely fly.

33

## HEAD LOUSE

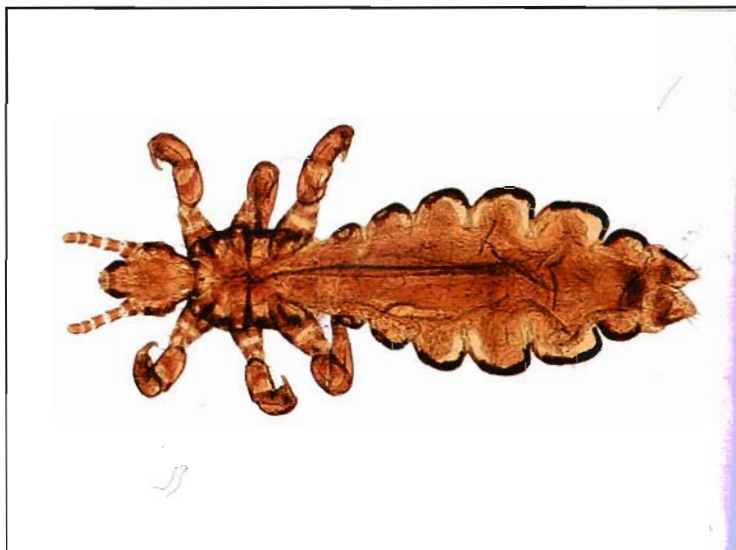
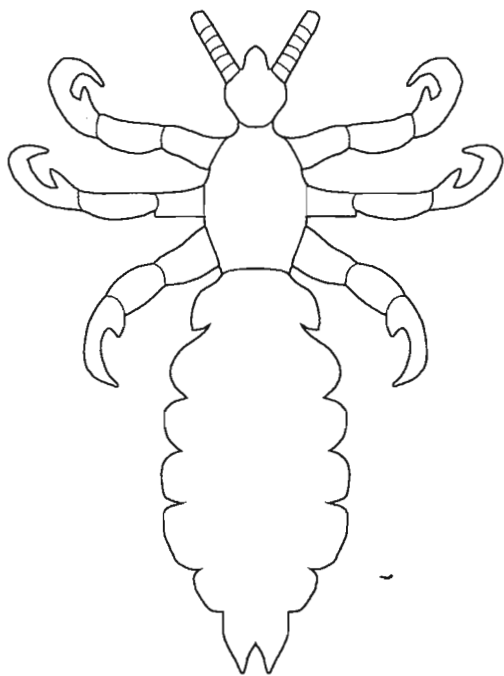
LIFECYCLE: INCOMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN PEDICULIDAE:

1/32 – 1/8 in  
(1<sup>1/2</sup> – 3<sup>1/2</sup> mm)

2



## DIET

The head louse feeds on human blood.

Feeling lousy? Rich or poor, clean or grungy, young or old—anyone can get head lice. These blood-sucking parasites have been making people scratch their heads for thousands of years. Adults cannot hop or fly, but cling tightly to the hairs of their host animal. If they drop off, they cannot survive more than a day or so without a blood meal.

So how do they spread so fast? First of all, lice have an amazing rate of reproduction. Each female louse lays about 100 eggs (called nits)

in her lifetime—five or six eggs a day. Within a week, the nymphs hatch out, and begin biting into the scalp and sucking blood. In another two weeks, these nymphs are already adults, mating and laying hundreds more eggs.

Secondly, people often get close enough for lice to crawl from one head to another. Or sometimes people share clothing or hair-related items that harbor live lice. Luckily, there are lots of treatments available for getting rid of lice these days.

## FIELD NOTES

**CAUTION:** Head lice are easily transferred by head to head contact.

## MAYFLY

34

LIFECYCLE: INCOMPLETE METAMORPHOSIS

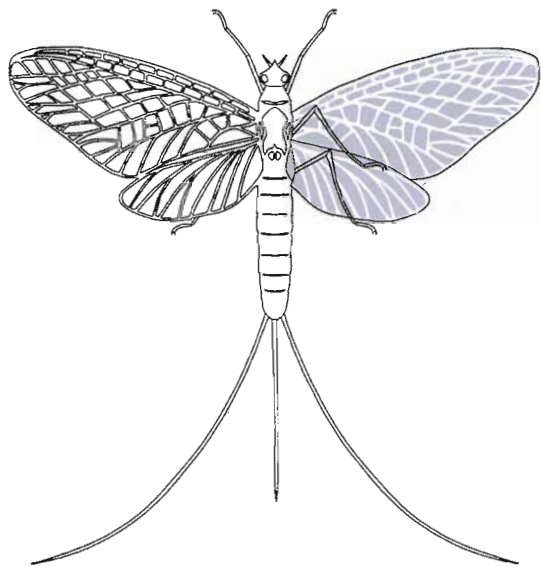
ADULT SIZE:

# OF SPECIES IN EPHEMERIDAE:

A winged sub-adult emerges and molts again to produce a sexually functioning adult.

3/8 – 1<sup>1/4</sup> in  
(10 – 34 mm)

150



## DIET

Mayfly nymphs eat mostly non-living organic matter and algae.

The adults have no functioning mouthparts and do not eat.

Mayflies are unique. They are the only insects that have two winged stages. Following the last nymphal stage, a dull-colored, winged sub-adult emerges. But this form is not yet a mature adult. In a very short time, the sub-adult mayfly molts once again. Now it is a brightly colored and sexually mature adult capable of reproducing. The mayfly is also unusual in that it holds its wings pointing straight up, never folded.

Mayflies are known as "indicator" species because the aquatic mayfly nymphs can only live in clean water with lots of oxygen in it. When they are present, mayfly nymphs indicate good water quality.

Both nymphs and adults are an important part of the food chain. They are found in great abundance and provide food for many different kinds of birds, fish, and small mammals.

## FIELD NOTES

Look for mayfly nymphs in unpolluted waterways.

The adults emerge in warm weather. Mature males form large swarms near water, often at dawn or dusk. Females visit the swarms to locate a mate.

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## WALKING STICK

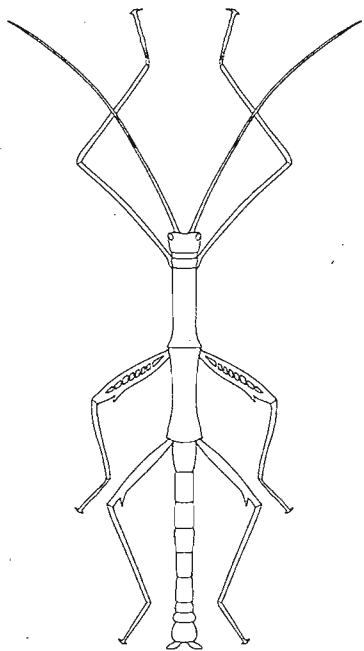
LIFECYCLE: INCOMPLETE METAMORPHOSIS

ADULT SIZE:

# OF SPECIES IN PHASMATIDAE:

1 – 1 1/2 in  
(25 – 290 mm)

2,500



## DIET

All walkingsticks eat plant material. One widespread species in the eastern U.S. prefers the leaves of oak trees.

The walkingstick has superb camouflage. Its long slender body and legs and its brown coloration make it look exactly like a small, leafless twig. When it sits motionless on a shrub or bush, it blends into the vegetation so well that it is nearly impossible for a predator to see.

Even the way a walkingstick moves is part of the disguise. It walks slowly and cautiously, never running or scampering about. It sways a little

from side to side with each step, and looks like a part of the branch moving with the wind.

Still, the walkingstick is preyed upon by many animals, especially birds, but also lizards, mantids, and rodents. If remaining motionless does not work as a defense, the walkingstick can also let off a foul smelling liquid to discourage predators.

## FIELD NOTES

The walkingstick is an especially challenging insect to spot. If it senses your motion, it becomes completely still, making it even more difficult to see. So the careful observer must remain quiet and motionless, and patiently wait for the insect's stiff, twig-like swaying motion to give it away. Also try collecting walkingsticks with a sweep net in fields.

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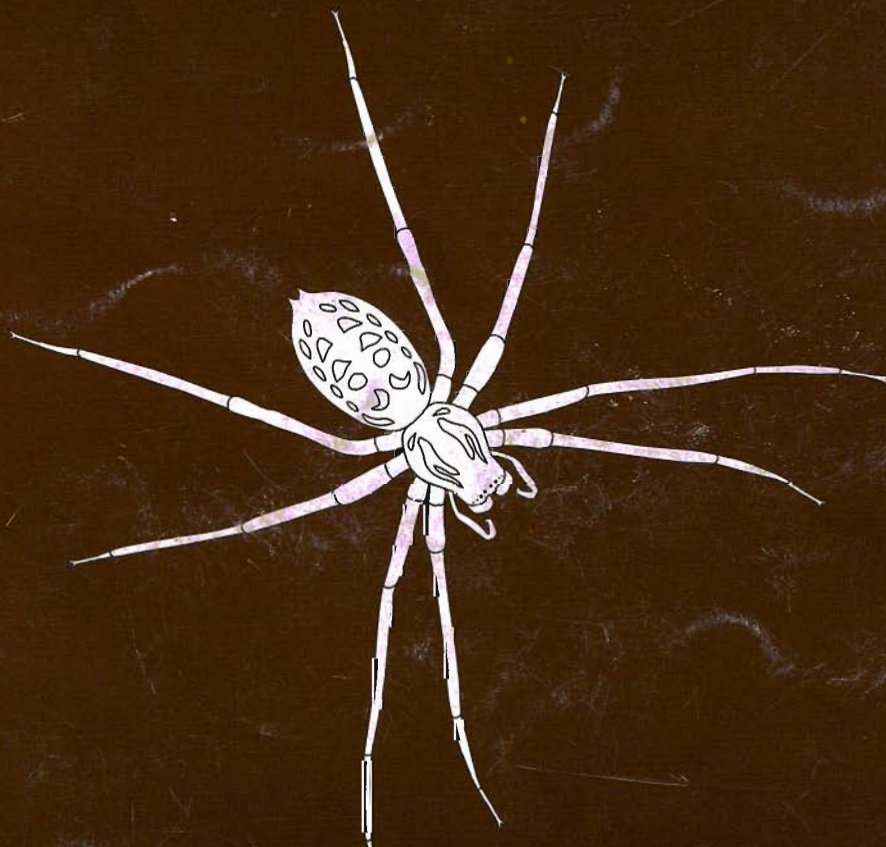


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