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2019

## What's Bugging You App

Elizabeth Sorensen

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# Elizabeth Sorensen M.S. Project

## What's Bugging You App

### 2019

<https://sorensen.github.io/dichotomous-key/#/>



WHAT'S BUGGING YOU?



Start

Glossary

Resources

Equipment

## Welcome to "What's Bugging You?"

This is a dichotomous key meant to help you identify the Order of the insect you've found. Each page will present you with 2 choices. Pick the one that matches your insect the best. If you pick the one you think is right, but the next one doesn't seem right, that's okay! Just go back and try again.

Along the way there will be help. Any words that are highlighted will give you a definition to explain what that word means. Pictures will be provided to help choose an option. These pictures may have multiple descriptions from the key, and sometimes will tell you what the insect is. When you get to the Order page, you will get a description of that order.

This key will only get you to the Order of the insect you find. That means that you will have a very general idea of where your insect belongs. If you want more information or help with identification, check the Resources page in the menu. Figuring out the family, genus, and even species will help you get the exact right insect.

Some of the questions in the key require you to get up close and personal with your insect. The easiest way to do this is to put the insect to sleep or to kill it. The most humane way to kill an insect is by freezing. Place the insect in a jar and put it in the freezer overnight. If you only want to make it sleepy, put it in the freezer for 15 minutes to half an hour. Check your insect to make sure it's slowed down or isn't moving before you remove it from the freezer. There is still a risk of it freezing to death, but it's not a bad way to go. Some of the questions may require a magnifying glass, but few will require a microscope. If you have access to a dissecting scope you are well on your way to being an entomologist! Check the Equipment page for more information on insect catching tools.

Have fun!  
Liz Sorensen

This dichotomous key was pulled in its entirety from Borror and DeLong's Introduction to the Study of Insects (7th ed.) by Triplehorn, C. A., & Johnson, N. F. (2005). The definitions are from many different places. All of the pictures are from the internet under the Creative Commons license or equivalent. Licensing information is available upon request. The descriptions of the Orders were taken from many places, including my education at UNL, Wikipedia, and BugGuide.net.



START



WHAT'S BUGGING YOU?



Start

Glossary

Resources

Equipment

## Choose one of the following

8 legs



6 legs



BACK

Abdomen obviously segmented



Abdomen not segmented



Abdomen has stinger



Abdomen doesn't have stinger, and specimen is <5mm



## Answer: Order Scorpiones

You may know them as scorpions. These arachnids are predatory, and use their venomous stinger and pinchers on their front legs to help them capture prey. Their stings can be painful, but most won't actually hurt you.

← BACK

## Answer: Order Pseudoscorpiones

Pseudoscorpions are tiny (almost always less than 5mm long) and are predators of insects. These arachnids do not have a stinger like the Scorpions, so they can't sting you. Actually if you've found one, consider yourself lucky! They are keeping away destructive bugs like ants, carpet beetles, and mites.

← BACK

There is a [Pedicel](#) between abdomen and cephalothorax



There is no [Pedicel](#)



## Answer: Order Araneae (Spiders)

Spiders are everywhere! Although they have fangs that can inject venom, most are not aggressive. There are over 45,000 spider species, but only a few can actually hurt you. Male spiders are often smaller than the female spiders. Spiders are good neighbors to have because they eat bugs and other spiders that might try to live in your house!

[← BACK](#)

## Answer: Order Acari (Mites and Ticks)

Mites are usually very tiny, and, depending on the genus, may be plant eaters, predators of insects, parasites (of insects and humans). You may have heard of dust mites, which don't feed on humans, but many people are allergic to them. Ticks tend to be larger than mites. They are all parasites and need blood to grow and reproduce. Many ticks feed on humans and other mammals, but some types of ticks feed birds, reptiles, or amphibians.

[← BACK](#)

Choose one of the following

☐ 8 legs☐ 6 legs[← BACK](#)

Choose one of the following

Specimen has well-developed wings

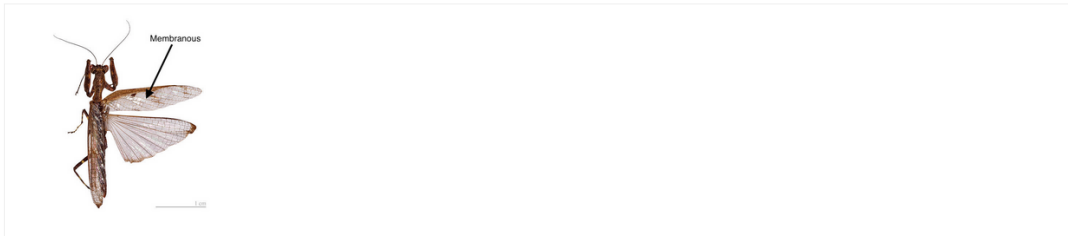


No wings (wingless or with wings vestigial or rudimentary ([Nymphs](#), [Larvae](#), and some adults))



← BACK

Wings membranous, not hardened or leathery



Front wings hardened or leathery at least at base, hind wings, if present, usually membranous



Choose one of the following

1 pair of wings



2 pairs of wings



← BACK

Choose one of the following

Body is grasshopper-like; [Pronotum](#) extending back over abdomen and pointed apically; enlarged hind legs



Body is not grasshopper-like; [Pronotum](#) not as in preceding item; hind legs not so enlarged



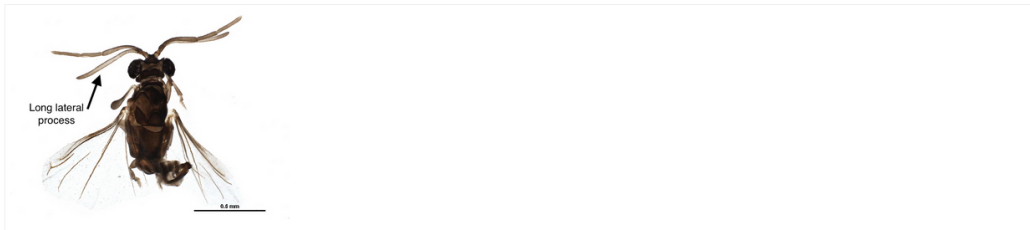
## Answer: Order Orthoptera (Specifically Family Tetrigidae (Pygmy Grasshoppers))

Pygmy grasshoppers are small compared to other insects in the order Orthoptera. They are also usually colored to blend into their surroundings, so congratulations if you found one! Many Tetrigidae like to be close to the water, and some even live in it! However, there are many that like to be up in the trees too. Orthopterans are hemimetabolous, which means the young ones (called nymphs) look like the adults, but the adults have wings.

[← BACK](#)

Choose one of the following

Antennae with at least 1 segment bearing a long lateral process; front wings minute, hind wings fanlike; minute insects



Not exactly fitting the preceding description

## Answer: Order Strepsiptera (Specifically Adult Male Twisted-Wing Parasites)

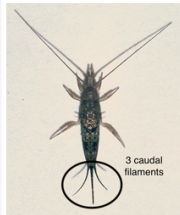
These guys are rare, so if you found one, pat yourself on the back! Male Strepsiptera look a lot like flies, but they can't use their mouths to feed (the mouth is vestigial). The adult males don't live for very long- just enough to find a female and mate. Strepsiptera are parasites of other insects. Strepsiptera are holometabolous, which means the larvae don't look anything like the adults, and there is a pupal stage between the larval and adult stages. Metamorphosis happens during the pupal stage.

[← BACK](#)



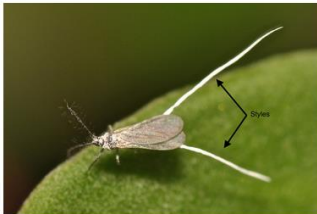
Choose one of the following

Abdomen has 1-3 **Caudal filaments** that are styletlike; mouthparts vestigial



Abdomen does not have thread or stylet-like **Caudal filaments**; mouthparts nearly always well-developed, mandibulate or haustellate

**Antennae** long and conspicuous; abdomen terminating in long style (rarely 2 styles); wings with single forked vein; halteres present, usually terminating in hooklike bristle; <5mm



**Antennae** short, bristlelike, inconspicuous; abdomen with 2-3 threadlike caudal filaments; wings with lots of veins and cells; no halteres; usually >5mm



## Answer: Order Hemiptera (Specifically Adult Male Scale Insects)

If you've ever seen a scale insect, it was probably a female. The males don't eat, and die quickly, living only long enough to mate. Since they die so fast, it is rare to find a male scale insect, so if you did, good work!

[← BACK](#)

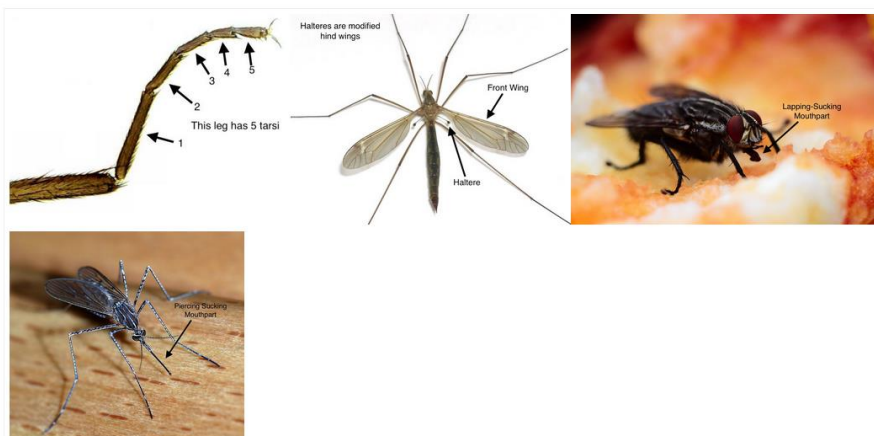
## Answer: Order Ephemeroptera (Mayflies)

Young mayflies live in the water (streams mostly, but sometimes lakes), so you will usually find adult mayflies close to water. Ephemeropterans are hemimetabolous, which means the young ones (called nymphs, but technically naiads) look like the adults, but the adults have wings. Mayflies are special, though. They have one last stage as a juvenile, but it also has wings. It is called a subimago. When mayflies molt into their sexually mature adult forms, they do so in huge numbers. They also form swarms when they're looking for mates. Fish and aquatic insects love to eat mayfly nymphs, so mayflies are considered an important part of the aquatic ecosystem. The nymphs also eat decaying things and algae in the water, so if you have a lot of mayflies, then you probably have a healthy stream!

[← BACK](#)

Choose one of the following

**Tarsi** nearly always 5-segmented; mouthparts piercing-sucking or lapping-sucking; hind wings reduced to **Halteres**



## Answer: Order Diptera (Flies)

Flies are everywhere! You are probably pretty familiar with many kinds, but maybe you just found one you thought was a wasp or a bee! Did you know that mosquitoes and midges are in the fly family? I hope you found out using the key! The halteres are one of the easiest ways to tell if you have a fly. Halteres are modified wings that give most Diptera the ability to be aerial acrobats (check out the glossary for more information on halteres). Dipterans are holometabolous, which means the larvae don't look anything like the adults, and there is a pupal stage between the larval and adult stages. Metamorphosis happens during the pupal stage.

[← BACK](#)

Tarsi 2-segmented or 3-segmented; mouthparts variable; hind wings reduced or absent (not haltere-like)



Mouthparts Mandibulate (some psocids)



Mouthparts are the piercing and sucking type





## Answer: Order Psocoptera (Booklice and Barklice)

The insects in the Order Psocoptera are mostly scavengers. When they're outside, they like to eat lichen and fungi, but if they get inside they might eat the paste in your book bindings or the glue that holds wallpaper to walls! This doesn't happen very often though, compared to other types of insects that like to eat starch. Psocoptera mainly live outside. They are hemimetabolous, which means the young ones (called nymphs) look like the adults, but the adults have wings.

[← BACK](#)

## Answer: Order Hemiptera (Specifically Some Planthoppers and Leafhoppers)

Planthoppers and leafhoppers can look a lot alike. They both suck sap from plants, and may pass diseases to those plants. In order to figure out which one you have, you'll have to do some more research. Check out the Resources page to find out more! Hemipterans are hemimetabolous, which means the young ones (called nymphs) look like the adults, but the adults have wings.

[← BACK](#)

Choose one of the following

Wings largely or entirely covered with scales; mouthparts usually in the form of a coiled [Proboscis](#); [Antennae](#) many-segmented



Wings don't have scales; mouthpart not a [Proboscis](#); variable [Antennae](#)



## Answer: Order Lepidoptera (Butterflies and Moths)

All of the insects in the order Lepidoptera have scales on their wings, which are actually just flattened hairs. If you touch the wings, some of those scales might come off on your hands- it doesn't hurt them! Although butterflies and moths look a lot alike, there are some general differences to help you guess which one you have. Remember, these aren't always true for every Lepidopteran! Butterflies usually fly during the day, but moths tend to fly at night. When butterflies rest, they like to hold their wings up over their bodies, while moths often hold them out to the sides. Butterflies are usually very colorful, and moths are not (they're often shades of brown and grey). Moths have a thing called a frenulum, which is a hook that keeps the front and hind wings together when they fly. Butterflies don't have a frenulum. Lepidopterans are holometabolous, which means the larvae don't look anything like the adults, and there is a pupal stage between the larval and adult stages. Metamorphosis happens during the pupal stage. Although you might not get to see it, a moth's pupal case is called a cocoon, and has a cover of silk. A butterfly's pupal case is called a chrysalis, which is hard and smooth.

[← BACK](#)

Choose one of the following

Wings long and narrow, veinless or with only 1 or 2 veins, fringed with long hairs; **Tarsi** 1-or 2-segmented, last segment swollen; <5mm long



Wings not as described, or if they are somewhat linear, then **Tarsi** have more than 2 segments

## Answer: Order Thysanoptera (Thrips)

Thrips have "hairy" wings, which are not very good for flying. Thrips are tiny insects, and mostly feed on plants by sucking up the sap. Thrips are considered pests because they can give diseases to the plants they feed on. However, some thrips are pollinators, and others are actually predators of other insects. Thysanoptera are hemimetabolous, which means the young ones (called nymphs) look like the adults, but the adults have wings.

[← BACK](#)

Choose one of the following

Front wings relatively large, usually triangular; hind wings small, usually rounded; wings at rest held together above body; wings usually with many veins and cells; **Antennae** short, bristlelike, inconspicuous; abdomen with 2 or 3 threadlike caudal filaments; delicate, soft-bodied



Not exactly fitting the preceding description

## Answer: Order Ephemeroptera (Mayflies)

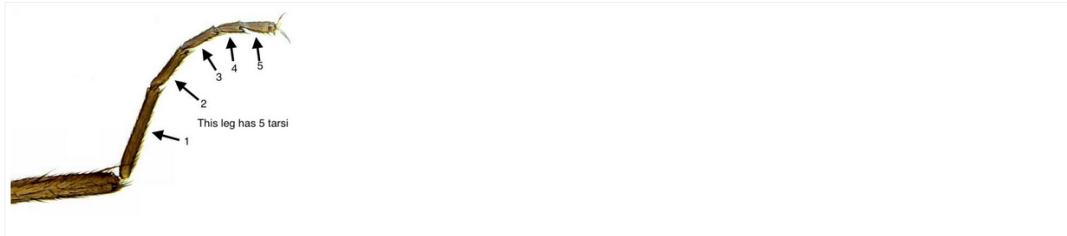
Young mayflies live in the water (streams mostly, but sometimes lakes), so you will usually find adult mayflies close to water. Ephemeropterans are hemimetabolous, which means the young ones (called nymphs, but technically naiads) look like the adults, but the adults have wings. Mayflies are special, though. They have one last stage as a juvenile, but it also has wings. It is called a subimago. When mayflies molt into their sexually mature adult forms, they do so in huge numbers. They also form swarms when they're looking for mates. Fish and aquatic insects love to eat mayfly nymphs, so mayflies are considered an important part of the aquatic ecosystem. The nymphs also eat decaying things and algae in the water, so if you have a lot of mayflies, then you probably have a healthy stream!

← BACK



Choose one of the following

Tarsi 5-segmented

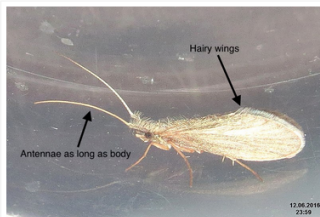


Tarsi with 4 or fewer segments



Choose one of the following

Front wings noticeably hairy; mouthparts usually much reduced except for palps; [Antennae](#) generally as long as body or longer; rather soft-bodied



Front wings not hairy (at most microscopic hairs); [Mandibles](#) well developed; [Antennae](#) shorter than body



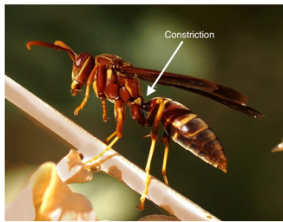
## Answer: Order Trichoptera (Caddisfly)

Caddisflies have very interesting larvae (babies). They all live in freshwater, and some make a protective case for themselves. They spin it from silk and then attach small bits of their substrate to it, such as twigs, pieces of gravel, and pieces of plants or anything else they can find. Some larvae are herbivorous, while others are predators. The adults don't usually eat anything, and only live long enough to mate. The caddisfly adults can easily be mistaken for moths. If you have lots of caddisflies, you probably have healthy bodies of water! Trichopterans are holometabolous, which means the larvae don't look anything like the adults, and there is a pupal stage between the larval and adult stages.

[← BACK](#)

Choose one of the following

Rather hard-bodied, wasplike insects, abdomen often constricted at base; hind wings smaller than front wings, with fewer veins; front wings with 20 fewer cells



Soft-bodied insects, not wasplike, abdomen not constricted at base; hind wings about the same size as front wings and usually with about as many veins; front wings often with more than 20 cells

## Answer: Order Hymenoptera (Sawflies, Ants, Wasps, Bees, Ichneumonids, Chalcidoids)

The order Hymenoptera is HUGE! There are over 150,000 species in this order. Did you know that ants are related to bumble bees? There are so many different genera, in fact, that it would be impossible to tell you about them all here. So check out the Resources page for more information! Hymenoptera are holometabolous, which means the larvae don't look anything like the adults, and there is a pupal stage between the larval and adult stages.

[← BACK](#)



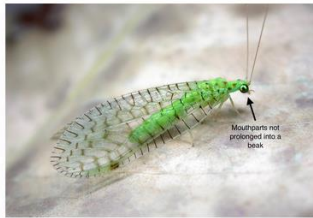
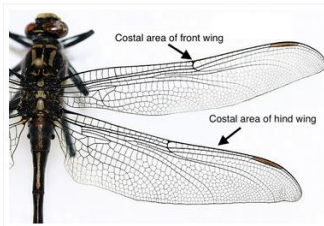
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← BACK

Choose one of the following

Costal area of front wing nearly always with numerous crossveins, or if not, then hind wings shorter than front wings; mouthparts not prolonged ventrally into beak



Costal area of front wings with not more than 2 or 3 crossveins; mouthparts prolonged ventrally to form beaklike structure



## Answer: Order Neuroptera (Fishflies, Dobsonflies, Lacewings, and Antlions)

You may have noticed that your Neuropteran has big eyes! These are their compound eyes, and make them great at finding food. Most of the larvae (babies) of this order are predators. The ones that are like to camouflage themselves in debris, or, in the case of antlions, dig pits! On the other hand, only some of the adult neuropterans are predators. Some don't eat at all, and others drink nectar. Because they can be predatory, insects in the group Neuroptera are our friends! Neuropterans are holometabolous, which means the larvae don't look anything like the adults, and there is a pupal stage between the larval and adult stages.

← BACK

## Answer: Order Mecoptera (Scorpionflies)

Some scorpionflies look like they have a stinger, but it's actually the male genitals! The abdomens of female scorpionflies just taper at the end. The big beaks of scorpionflies are usually used for scavenging; they eat dying plants and dead insects. Mecopterans usually like to live in moist areas with lots of decaying leaf litter, like forests. Eggs need a lot of moisture to hatch, and when they do, the larvae look like caterpillars. Mecopterans are holometabolous, which means the larvae don't look anything like the adults, and there is a pupal stage between the larval and adult stages.

← BACK

Choose one of the following

Hind wings as long as front wings and of same shape or wider at base; wings at rest held above the body or outstretched (never held flat over abdomen); wings with many veins and cells; **Antennae** short, bristlelike, inconspicuous; abdomen long, slender; tarsi 3-segmented; length 20-85mm



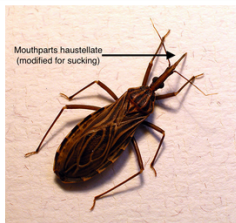
Not exactly fitting the preceding description

## Answer: Order Odonota (Dragonflies and Damselflies)

Dragonflies and damselflies look a lot alike. They both have very large compound eyes, which help them to be great hunters, able to capture prey in flight. This is good, because Odonata are predators as juveniles and adults! However, they are different in a lot of ways too, so it shouldn't be too hard to tell which one you have. Damselflies look a lot more delicate than dragonflies. The big eyes of the dragonfly basically touch at the back of the face, but there is a gap between them on damselflies. Damselflies hold their wings back at rest, while dragonflies hold them out to the sides. Congratulations if you caught one- they're good fliers! Odonatans are hemimetabolous, which means the young ones (called nymphs, but technically naiads) look like the adults, but the adults have wings.

[← BACK](#)

Mouthparts [Haustellate](#)



Mouthparts are [Mandibulate](#)



## Answer: Order Hemiptera

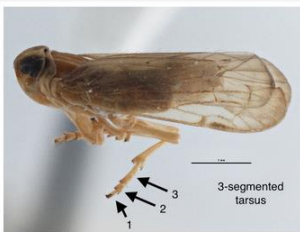
Did you know that all bugs are insects, but not all insects are bugs? That's because the order Hemiptera contains the "true" bugs! But don't be fooled: just because an insect has "bug" in its name, doesn't mean it's a hemipteran. Ladybugs, for example, are beetles. All hemipterans have "piercing-sucking" mouthparts. Mostly they use these mouthparts on plants, but there are some predators, and even some blood-feeders (bedbugs and kissing bugs). Many insects in this order are considered pests of plants. Hemipterans are hemimetabolous, which means the young ones (called nymphs) look like the adults, but the adults have wings. There are at least 50,000 species in this order, so you may have to do more research to find out which bug you have. Check the Resources page next!

[← BACK](#)

**Tarsi** 4-segmented; front and hind wings similar in size, shape, venation; **Cerci** minute or absent



**Tarsi** 3-segmented or fewer; hind wings usually shorter than front wings; **Cerci** are present or absent



## WHAT'S BUGGING YOU?

Start Glossary Resources Equipment

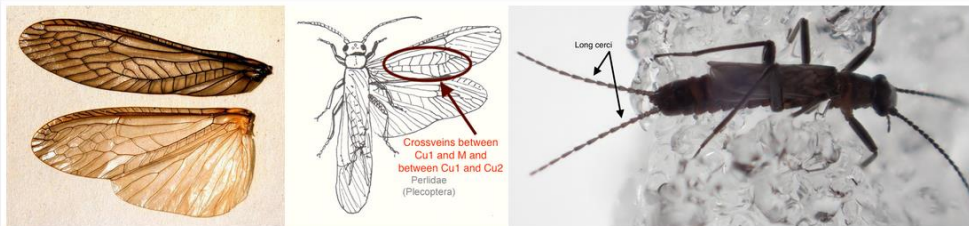
## Answer: Order Isoptera (Termites)

You can easily tell the difference between a termite and an ant, because termites don't have a constricted waist (see Hymenoptera). Termites are "eusocial" insects, and live in large colonies. The term eusocial means that the castes (workers, soldiers, kings, and queens) all look different, even if they're the same species. It also means that they take care of their young, and defend their colonies (among other things!). Termites eat cellulose, so that means that they often eat wood, but it can also be other types of plant material. Termites are actually very important for ecosystems, even though they are considered pests when they're in our houses. Some termites make nests, and some live underground in mounds. But they'll always be found in warm areas, because they are considered "soft" bodied, which means they freeze easily. Isoptera are hemimetabolous, which means the young ones (called nymphs) look like the adults, but the adults have wings. Development is complicated in this order, though, due to the different castes.

← BACK

Choose one of the following

Hind wings with anal area nearly always enlarged and forming a lobe, which is folded fanwise at rest; venation varying from normal to very dense, the front wings usually with several crossveins between Cu1 and M and between Cu1 and Cu2; **Cerci** present, often fairly long; mostly >10mm in length; nymphs aquatic, adults usually found near water



Hind wings without enlarged anal area and not folded at rest, with no extra crossveins; **Cerci** present (but short) or absent; mostly 10mm or less in length; nymphs not aquatic, adults not necessarily near water

## Answer: Order Plecoptera (Stoneflies)

The nymphs of stoneflies are aquatic, so the adults are usually found near the water. Despite their many-veined wings, they are not very good fliers. Adults may not be able to eat, but the ones that do only eat plants. The adults only live for a few weeks, but the nymphs can live for up to 4 years! Stonefly nymphs need water with a lot of oxygen in it, so if you found one, congratulations! You have a very healthy body of water near you! Plecopterans are hemimetabolous, which means the young ones (called nymphs, but technically naiads) look like the adults, but the adults have wings.

[← BACK](#)

Tarsi 3-segmented, basal segment of front enlarged



Tarsi 2-segmented or 3-segmented, basal segment of front not enlarged



WHAT'S BUGGING YOU?

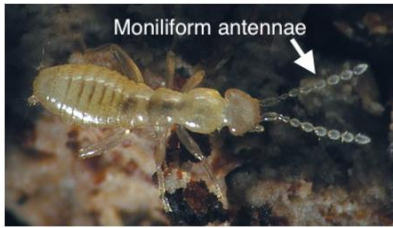
Start Glossary Resources Equipment

## Answer: Order Embiidina (Webspinners)

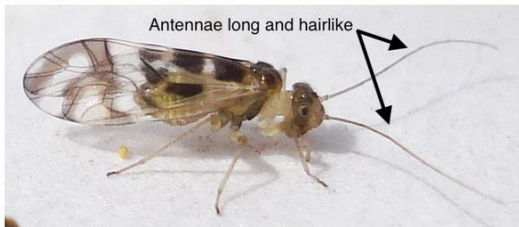
Webspinners use the silk they spin to make "galleries" that they live in. In their galleries they are protected from predators among other things. A gallery usually has more than just one webspinner in it. The females lay their eggs in the gallery, and take care of them for a little while after they hatch. Webspinners eat plants, except for the adult males, which don't eat at all. The males die quickly, so they leave the gallery as soon as they can to find a mate. If you've found a webspinner, good job! They are pretty rare. Webspinners are hemimetabolous, which means the young ones (called nymphs) look like the adults, but the adults have wings.

← BACK

Cerci are present; tarsi with 2 segments; wing venation reduced; Antennae moniliform and 9-segmented



Cerci absent; tarsi with 2 segments or 3-segmented; wing venation not particularly reduced; Antennae not moniliform, usually long and hairlike, with 13 or more segments



WHAT'S BUGGING YOU?



Start

Glossary

Resources

Equipment

## Answer: Order Zoraptera (Angel Insects)

These little guys are very rare, so if you found one, congratulations! There are only 44 species that we know of, in one genus: Zorotypus. Zorapterans live in colonies in or under rotting wood, and mainly eat fungal spores and dead plant material. Sometimes they are hunters of other tiny insects and mites.



BACK



WHAT'S BUGGING YOU?



Start

Glossary

Resources

Equipment

## Answer: Order Psocoptera (Psocids; Booklice and Barklice)

The insects in the Order Psocoptera are mostly scavengers. When they're outside, they like to eat lichen and fungi, but if they get inside they might eat the paste in your book bindings or the glue that holds wallpaper to walls! This doesn't happen very often though, compared to other types of insects that like to eat starch. Psocoptera mainly live outside. Psocopterans are hemimetabolous, which means the young ones (called nymphs) look like the adults, but the adults have wings.



BACK





## Glossary

### Antennae

Singular: antenna, when used in a description: antennal (e.g. antennal segments). There are many types of antennae. Antennae are located on an insect's head, and give the insect sensory information.

### Caudal filament

A threadlike projection from the last abdominal section. May be more than one.

### Cerci

Singular: cercus. A paired appendage on the last segment of an insect's abdomen. Usually used as a sensory organ.

### Compound Eyes

A compound eye is a large eye structure. It is made up of a bunch of individual eyeparts called ommatidia- each one has an individual lens. Compound eyes are good for detecting movement, but don't produce a sharp image like a human eye.

### Ectoparasite

An animal that lives externally on another animal, but doesn't kill it.

### Halteres

A modified wing (usually the hind wing) that is used for balance (like a gyroscope). Often looks like a drum stick.

### Haustellate

Mouthparts that are modified for sucking liquids. Might be a stylet (Mosquitoes), a brushlike tongue (flies), a coiled tube (butterflies and moths), or a piercing tube (aphids).

### Hemimetabolous

Type of insect development where there is no pupal stage between juvenile and adult.

### Holometabolous

Type of insect development where there is a pupal stage between juvenile and adult.



## Hypognathous

■ Mouthparts that project downward from the head.

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## Larvae

■ Singular: larva. Juvenile form of a holometabolous insect.

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## Mandible

■ Plural: mandibles. Insect jaw: used for cutting , biting, and sometimes gripping. See "mandibulate."

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## Mandibulate

■ Mandibulate mouthparts are modified for chewing or scraping. Have a labrum (lower lip), mandibles, and clypeus (upper lip).

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## Maxilla

■ Plural: maxillae. A mouthpart that is paired with the mandibles, and are used to hold and move food around while biting or cutting with mandibles.

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## Moniliform

■ Like a string of beads. See picture in description of antennae.

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## Naiad

■ The aquatic juvenile form of a hemimetabolous insect

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## Nymph

■ The juvenile form of a hemimetabolous insect

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## Ocelli

■ Singular: ocellus. Light-detecting organs used to detect movement. Also called "simple eyes."

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## Pedicel

■ A pedicel is a thin structure that connects the thorax to the abdomen

## Proboscis

Type of haustellate mouthpart; at rest it's often coiled, in use it is long and tube-like.

## Prognathous

Mouthparts that project outward from the head.

## Prolegs

Prolegs are found on insect larvae such as caterpillars. They are fleshy and not true legs. Prolegs may have crochets (tiny hooks) on them.

## Pronotum

A plate-like structure that covers all or part of the top of the thorax. Not all insects have pronotums.

## Stemmata

Singular: stemma. Stemmata are simple eyes in holometabolous larvae (not to be confused with ocelli).

## Tarsi

Singular: tarsomere. The tarsi are sections of the tarsus, which is the last segment on the leg of an insect. There may also be a claw, called a tarsal claw.

## Wing pads

The place on the body of a nymph where wings will form on the adult.



## WHAT'S BUGGING YOU?



[Start](#) [Glossary](#) [Resources](#) [Equipment](#)

## Resources

Here you will find links to pictures of insects that may help you figure out the family, genus, or species you have.

Bug Guide

<https://bugguide.net>

Amateur Entomologist's Society

<https://www.amentsoc.org>

Insect Images

<https://www.insectimages.org>

Encyclopedia of Life

<https://eol.org>

Wikipedia

<https://www.wikipedia.org>

JungleDragon

<https://www.jungledragon.com>

## Equipment

Here you will find links to places where you can buy equipment for inspecting and/or collecting insects.

BioQuip: everything you need to start collecting insects, including information on how to collect insects!  
<https://www.bioquip.com>

How To Start an Insect Collection:  
<https://bugguide.net/node/view/36900>