



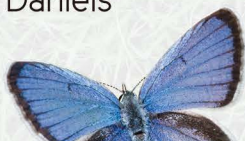
Insects & Bugs for Kids



BUTTERFLIES, BEES, AND MORE

An Introduction to Entomology

Jaret C. Daniels



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Adventure Publications
Cambridge, Minnesota

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Disclaimer Kids should always be accompanied by an adult when outdoors, and it's your responsibility to recognize, and avoid, the potentially dangerous bugs, insects, plants, or animals in your area. Always be aware of the weather and your environmental surroundings, and stay off private property. Finally, don't handle bugs or insects unless you're certain it's safe to do so.

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All About Bugs

If you want to observe or study bugs, it helps to know a bit more about them first. The term “bug” is generic and typically refers to a wide assortment of small, creepy-crawly critters. All bugs are **arthropods** (say it, *ar-thro-pods*). Arthropods are invertebrates—they don’t have an internal skeleton and bones. Instead, they have an external skeleton, a segmented body, and jointed appendages, such as legs and antennae. The arthropods are a large group of animals that includes insects, crustaceans, spiders, centipedes, millipedes, and scorpions. Together they are the largest, most diverse and widespread group of animals on the planet, representing nearly 85 percent of all known animal species.

ARTHROPOD EXAMPLES



Jumping Spider (spider)



Pillbug (crustacean)



Millipede (millipede)



Monarch Butterfly (insect)



Stone Centipede (centipede)

Insects are by far the most familiar and frequently encountered arthropods. They are also incredibly diverse, with over 1 million known species. The vast majority of species on Earth that are yet to be described are likely insects and other arthropods. In fact, scientists conservatively estimate that the total number of insects could exceed 8 million when all are eventually discovered. While the vast majority of that amazing diversity exists in the tropics, there are well over 150,000 species of insects in the United States and Canada alone. They are also incredibly abundant. Although it may sound crazy, there are about 1.5 billion insects on Earth for every human being.

Entomology (say it, *ent-o-mall-o-gee*) is the study of insects. It is a big scientific field that makes contributions to biology, agriculture, chemistry, human and animal health, conservation, the environment, medicine, and even criminal investigation (forensics).

Entomologists work in laboratories and out in nature (fieldwork). They identify new species and uncover evolutionary relationships between species. They help



Some insects, such as Tomato Hornworms (a moth caterpillar), can cause damage to plants or crops.

ensure safe and sustainable food production; help us fight plant, animal, and human diseases; work to prevent pest damage to homes, landscapes, and the environment; and many other useful things. They even help conserve rare and endangered species.

But you don't have to have a college degree to enjoy or study insects. Anyone can learn about and enjoy insects, and even collect valuable scientific information or make new discoveries. Today, there are also many opportunities for citizen scientists—members of the general public who help collect and analyze data—to contribute. No matter if you're interested in butterflies, ants, ladybugs, bees, or even earthworms, there are a great many citizen science programs available, and kids can participate in many cases too!

Of course, the first step is probably just exploring and getting to know the many different types of bugs that are right outside your front door.

Butterflies, like this Tiger Swallowtail, are a perennial favorite with all ages.



AN INSECT'S BODY

All insects share several common features. Unlike humans, other mammals, birds, reptiles, and amphibians, insects lack an internal skeleton. Instead, they have a hard (or generally hard) outer covering called an **exoskeleton**. It serves several functions including protection and support. Like armor, it helps guard the insect's body from damage and water loss (**desiccation**). The exoskeleton also provides support for muscle attachments, which helps bugs move.



Japanese Beetle

The invasive Japanese beetle provides a good example of an insect's hard exoskeleton.

An insect's body is divided into three main sections: the **head**, **thorax**, and **abdomen**. An insect's head helps the insect sense the world around it; it has two **compound eyes**, two segmented antennae, and mouthparts. The round, and often large, compound



An extreme close-up of a hoverfly's eye

eyes are made up of hundreds of tiny individual lenses. Working together, they provide a single, somewhat grainy (or pixelated) image and gives insects rather good vision, especially

for both distance and motion. Above the eyes are two segmented **antennae**. They contain sensory structures that help with smell, taste, touch, and orientation.



A look at a carpenter ant's antennae

Mouthparts are located on the front of the head.

The type of mouthparts vary tremendously between different insect groups. Grasshoppers, beetles, and moth and butterfly caterpillars have hardened **mandibles** (jaws) designed for chewing.

Others, such as aphids, fleas and mosquitos, have piercing-sucking mouthparts that are a little like straws and used to feed on fluids. There are many other options across insects, including



Close-up of a house fly's mouth

mouthparts designed for sponging (flies), rasping-sucking (thrips, mites, and biting flies), and siphoning (butterflies and moths). Some insects even have highly reduced, nonfunctional (vestigial) mouthparts or may lack them all together. This is typically the case in one particular life stage, often the adult stage.



A White-Lined Sphinx Moth and its long tongue



As a result, some adult insects don't eat at all, but instead live off the energy reserves they've acquired in an earlier life stage.

A close-up look at an ant



The jaws of a tiger beetle

The **thorax** is an insect's second body section. It supports structures that enable insects to move. All insects have three pairs of jointed legs, one



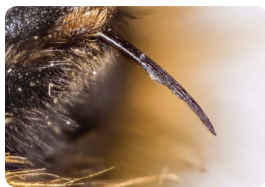
pair on each segment. Legs may be used for running, crawling, jumping, grasping, or capturing prey. Many insects also have one or two pairs of wings. Wings



Ladybugs have four wings.

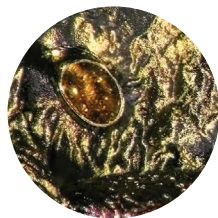
help insects fly, but they can also be used for other things, such as thermoregulation (temperature control), attracting mates, species recognition, sound production, camouflage, mimicry, and self-defense.

The last and usually the longest or largest section of an insect's body is the **abdomen**. It contains the reproductive, digestive, and excretory systems along with a series of small holes along the sides, called **spiracles**, which insects use to breathe. (Spiracles can also be found on the thorax.) In female



The stinger of a bumblebee

insects, the tip of the abdomen may have an added structure called an ovipositor, which is used to lay eggs. In some insects, such as bees, wasps, and some ants, the ovipositor



Spiracles viewed up close on a beetle

is modified into a stinger that can be used for self-defense or to capture prey.



Butterflies undergo complete metamorphosis.

INSECT DEVELOPMENT

All insects pass through a series of stages as they grow. This transition is known as **metamorphosis**. Many insects, such as butterflies, moths, flies, beetles, bees, and wasps, undergo complete metamorphosis, consisting of four developmental stages: egg, larva, pupa, and adult. The immature stages look very different than the adults, eat entirely different foods, and often live in separate environments. A good example of this is the life cycle of a butterfly. Caterpillars are worm-like in appearance, have hard, chewing mandibles (jaws) perfect for eating plants, can only crawl, and are typically found on plants. In comparison, adult butterflies have two large

compound eyes, two antennae, and four large wings. They can fly and easily move from one location to another, as well as feed on liquid flower nectar with a long, tubular mouthpart, called a **proboscis**.

Other insect groups, such as grasshoppers, dragonflies and damselflies, true bugs, cockroaches, and praying mantises, undergo **incomplete metamorphosis**. This developmental process has three stages: egg, nymph, and adult. The nymphs often closely resemble the adults in appearance, although they are smaller in size. They also typically share the same food resources and environment that adults do, and they often behave similarly. True bugs are a good example. The nymphs look like smaller versions of the adults.



Incomplete metamorphosis.

They have the same piercing-sucking mouthparts, feed on liquid food such as plant sap, live primarily on plants, and typically move by walking. The adults are somewhat larger, can reproduce, and have wings that enable flight.



A house fly feeding on fruit

WHAT INSECTS EAT

Insects feed on a wide range of different foods. Many are **herbivores** and feed on plants. Most are highly specialized and

consume specific plant parts, such as leaves, flowers, flower buds, seeds, or developing fruit. Some feed on plant roots, burrow into stems, suck plant sap, or feed on flower nectar or pollen. Other insects are **predators**. They primarily feed on other insects and arthropods.

Most are generalists, actively hunting for a variety of available organisms or sitting and waiting for prey to come close. Still others are

scavengers. They typically feed on dead plant or animal material or animal waste. Most are highly beneficial decomposers that help break down and recycle nutrients. Some insects, such as fleas, are **parasites**. They live on the bodies of other



A beetle eating a leaf

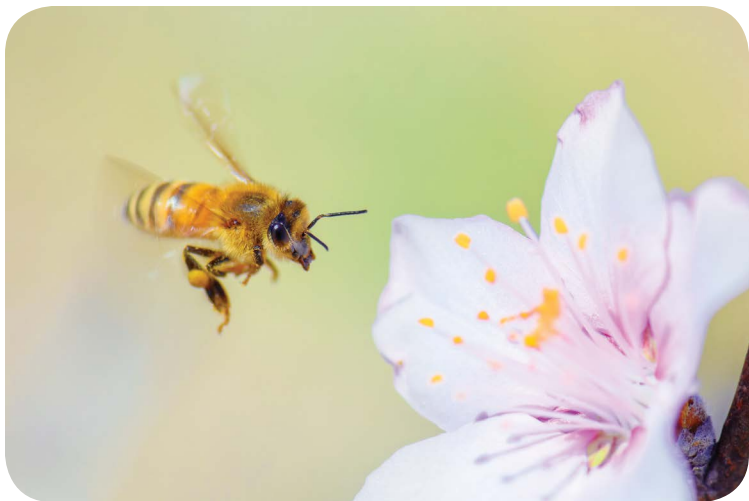
live organisms and feed on their blood. Some insects are **parasitoids**. Most of these are highly specialized flies or wasps. Their developing larvae feed inside or attached to the body of other organisms, primarily insects and arthropods, eventually killing them.



A damselfly eating its prey

WHY INSECTS ARE SMALL

Can you imagine a dragonfly the size of a large bird? Well, there really were insects that big in prehistoric times, some 300 million years ago. So why are insects so small today? This has been a puzzling question for scientists. One of the most likely answers is related to breathing. Insects breathe through small holes on the outside of their body, called spiracles. These in turn are attached to a complex network of small tubes, called tracheae, which help transport oxygen directly to the insect's body. This system works well for small organisms but becomes much less efficient as body size increases and is limited by the amount of available oxygen in the atmosphere. Hundreds of millions of years ago, oxygen levels were much higher than today, enabling insects to grow much larger.



Honeybees are especially important pollinators for farm crops.

WHY INSECTS ARE IMPORTANT

Insects get a bad rap. They are often considered undesirable, harmful, scary, unclean, or otherwise gross. The real truth is that insects are essential to the health and function of the natural world and our own wellbeing. They are an important food source for many other organisms, including mammals, birds, reptiles, amphibians, other arthropods, and even humans. They help pollinate over 85 percent of all flowering plants on the planet. This includes numerous food crops, such as almonds, blueberries, apples, and even chocolate. In other words, insects are responsible for much of the food that we eat and enjoy every day. Beyond the food humans depend on, the fruits, nuts, and seeds produced by plants provide food for

countless other organisms and ensures that plants can reproduce.

Still other insects are **decomposers**, feeding on dead animal and plant material and animal waste. Such insects are nature's recycling crew, helping break down organic matter. In the process, valuable nutrients are recycled back into the soil, water and air. These help plants grow and provides important resources for other organisms.

Many insects are predators. They feed on a wide range of other small creatures, primarily other insects and arthropods. By doing so, they help control garden, agricultural, forest, or other pests such as mosquitoes that may transmit diseases to people or are often considered a nuisance.

Insects also help scientists make important discoveries. Many have been well studied and are considered model organisms for medical, biological, or environmental research. These are organisms used to help better understand how nature works. Fruit flies, for example, have been used to increase our knowledge of genetics, behavior, and human diseases.

Insects also serve as indicators of environmental health or change. The presence or absence of many aquatic insects, such as mayflies, can be used to estimate the level of pollution in streams and rivers. Butterflies and moths are often used to help

us understand the effects of habitat loss, pollution, pesticide use, or a changing climate.

Types of Bugs

While this book focuses mostly on insects, we have also included a few other arthropods. Arthropods belong to the phylum Arthropoda and represent the largest and most successful group of organisms in the animal kingdom. They include insects, spiders, millipedes, centipedes and crustaceans, and can be divided into more than 30 different subgroups called orders. The members of each have certain basic characteristics and behaviors that can be particularly



Pillbug

useful for identification. The following include some of the most interesting, distinctive, and commonly found orders covered in this book. Insects, are included in

the book first, followed by familiar arthropods, such as spiders, centipedes, and millipedes, which are arthropods, but not insects.



BUTTERFLIES AND MOTHS (ORDER LEPIDOPTERA)

Butterflies and moths are probably one of the most familiar insect groups. The adults are often large, brightly colored, and pretty easy to spot. They have two pairs of transparent wings that are covered with numerous tiny scales that determine their color and pattern. They have two large compound eyes, two elongated segmented antennae, and straw-like mouthparts (although in some species they are highly reduced or nonfunctioning) that help them feed on various fluids such as flower nectar. Butterflies are active during the day. While most moths fly only at night, there are some that can be seen during the day or at dusk and dawn. Many actively visit flowers and are important pollinators. Butterflies and moths undergo a complete metamorphosis, developing through four stages: egg, larva (or caterpillar), pupa, and adult. The larvae, known as caterpillars, are primarily plant feeders and have chewing mouthparts.



BEES, WASPS, AND ANTS (ORDER HYMENOPTERA)

This is a large and diverse group of insects. Many species have complex social systems that include elaborate nests and a division of labor, with groups of individuals (**castes**) having specific jobs that benefit the entire colony. Adults typically have two pairs of transparent wings (although some species or individuals don't have wings), and two large compound eyes. Wasps and ants have chewing mouthparts, and bees have a tongue for feeding on liquids such as flower nectar. The majority of adults also have a narrow waist between the thorax and abdomen.

Many adult bees and wasps feed on nectar and/or pollen. These tend to be common flower visitors and beneficial pollinators. Most ants, however, are predators or scavengers, feeding on a wide range of available food. All bees, wasps, and ants undergo a complete metamorphosis, developing through four stages: egg, larva, pupa, and adult. The larvae feed on a variety of resources including pollen, nectar, plant material, and even other insects. In many cases, this food is initially provided by adults or in a social colony. Some species may also be parasitoids on other insects or arthropods. Many bees, wasps, and ants can sting or bite, particularly if threatened.



TRUE BUGS (ORDER HEMIPTERA)

This is another large and diverse insect group. They vary considerably in their size, appearance and behavior. Adults have two pairs of wings, the first pair being partially thickened at the base. Their wings fold over the back of the insect's body, often resulting in a distinctive X-shaped pattern. True bugs have piercing-sucking mouthparts. Many feed on plant juices while others are predatory and feed on other small organisms. True bugs undergo incomplete metamorphosis, developing through three stages: egg, nymph, and adult. The nymphs often closely resemble the adults in appearance. Most true bugs live on land and on vegetation although a few groups are aquatic and occur in freshwater habitats.



BEETLES (ORDER COLEOPTERA)

Beetles are incredibly diverse. With nearly 400,000 different species, they represent about 40 percent of all known insects. The adults tend to be rather large, full-bodied, and somewhat round or oval in shape.

They have two pairs of wings. The first one is modified into hard, often shiny protective covers called elytra. These cover the two larger wings beneath that are used to fly. Beetles occur both in terrestrial (land) and aquatic (water) environments. They have chewing mouthparts with hardened mandibles (jaws) that are adapted for chewing. Some feed as predators on other small invertebrates, while others are herbivores and eat plant parts. Still others are scavengers on animal waste or dead plant or animal material.

Beetles undergo complete metamorphosis, developing through four stages: egg, larva, pupa, and adult. Beetles may be active during the day or at night, and many are attracted to artificial lights.



FLIES (ORDER DIPTERA)

Flies are a diverse group of insects that are often (unfairly!) considered unattractive or a nuisance. Adults have compact bodies, large compound eyes, short antennae, and one pair of transparent wings. The second pair of wings (rear wings) is modified into small, club-like structures, called halteres. These help stabilize the fly during flight. Adults may have one of several types of mouthparts; some are adapted for piercing, sucking, or sponging up liquid foods. Flies undergo a complete metamorphosis, developing through four stages: egg, larva, pupa, and adult. The larvae, called maggots, lack legs and live in a variety of different habitats, including on land and in the water where they feed on decaying plant or animal material or are predators of other animals. Many adults regularly visit flowers and are important pollinators. A small number of species are parasitoids on other insects.



DRAGONFLIES AND DAMSELFLIES (ORDER ODONATA)

This is a relatively small group that includes somewhat prehistoric-looking insects. Adults have large rounded heads, two large compound eyes, long, slender abdomens, and two pairs of elongated transparent wings with numerous veins. The adults are active during the day and are often brightly colored. They are predators with chewing mouthparts and use their long, spiny legs to capture prey in flight. Dragonflies and damselflies undergo incomplete metamorphosis, developing through three stages: egg, nymph, and adult. The nymphs, called naiads, live in freshwater habitats. They prey on various smaller insects and other aquatic organisms.



GRASSHOPPERS, CRICKETS, KATYDIDS, AND OTHERS (ORDER ORTHOPTERA)

Most members of this group are large, stout insects that are found on land. They have two relatively large compound eyes, antennae that are often long, and two pairs of wings. The first pair of wings is narrow, thick, and somewhat hardened and covers a second larger set of wings. Both pairs of wings are held over the back while the insect is at rest. In many species, the wings are not used for flight but are used to produce sound in order to attract mates. The hind legs are enlarged and used for jumping. Grasshoppers, crickets, and katydids undergo incomplete metamorphosis, developing through three stages: egg, nymph, and adult. The young nymphs closely resemble the adults in appearance. Both adults and nymphs have chewing mouthparts and mostly feed on plant material.



COCKROACHES AND TERMITES (ORDER BLATTODEA)

This is a small and ancient group of insects. Cockroaches have a somewhat flattened oval body, very long antennae, and two pairs of membranous wings. Some species are considered household pests. They have chewing mouthparts and feed on a variety of dead animal and plant material, including food scraps. They are generally active at night and hide in dark moist locations during the day. Termites are social insects much like wasps, ants and bees, and they have larger colonies. They have chewing mouthparts feed on dead plant material including wood. As a result, some species can cause serious damage to homes or other structures. Both cockroaches and termites undergo an incomplete metamorphosis, developing through three stages: egg, nymph, and adult.



ANTLIONS AND LACEWINGS (ORDER NEUROPTERA)

These tend to be somewhat small, delicate-looking insects that have slender, elongated bodies and two pairs of transparent wings with numerous fine veins. The predatory adults have chewing mouthparts and feed on other insects. The larvae are also predators that actively hunt, trap, or sit and wait for prey. They have modified jaw-like mouthparts to capture prey and suck out the internal fluids. They undergo a complete metamorphosis, developing through four stages: egg, larva, pupa, and adult. They tend to be very weak fliers and are often attracted to artificial lights at night.



EARWIGS (ORDER DERMAPTERA)

Earwigs are small and somewhat unique-looking insects. They have somewhat flattened, elongated bodies, long antennae, and two pairs of short leathery wings. On their rear end, they have a noticeable pair of pincer-like features called cerci. They undergo incomplete metamorphosis, developing through three stages: egg, nymph and adult. They are primarily active at night and hide in dark moist locations during the day. They have chewing mouthparts and tend to be scavengers, feeding on a variety of living and dead plant and animal material.

Recommended Reading

WEBSITES

Seek by iNaturalist (www.inaturalist.org/pages/seek_app): This application uses the camera on your smartphone or tablet, along with image recognition, to help you identify insects, plants, and other organisms.

BugGuide (www.bugguide.net/node/view/15740): An online resource providing identification, images, and information on insects, spiders, and their relatives for the United States and Canada.

Butterflies and Moths of North America

(www.butterfliesandmoths.org): An online resource providing information, images, and occurrence data for butterflies and moths.

FIELD GUIDES

Daniels, Jaret. *Insects & Bugs of North America: Your Way to Easily Identify Insects & Bugs* (Adventure Quick Guides). Cambridge, Minnesota: Adventure Publications, 2019.

Daniels, Jaret. *Backyard Bugs: An Identification Guide to Common Insects, Spiders, and More*. Cambridge, Minnesota: Adventure Publications, 2017.

Daniels, Jaret. *Butterflies of the Northeast: Identify Butterflies with Ease* (Adventure Quick Guides). Cambridge, Minnesota: Adventure Publications, 2019.

Daniels, Jaret. *Butterflies of the Northwest: Your Way to Easily Identify Butterflies* (Adventure Quick Guides). Cambridge, Minnesota: Adventure Publications, 2020.

Daniels, Jaret. *Butterflies of the Midwest: Identify Butterflies with Ease* (Adventure Quick Guides). Cambridge, Minnesota: Adventure Publications, 2016.

Eaton, Eric R. and Kaufman, Kenn. *Kaufman Field Guide to Insects of North America*. Boston: Houghton Mifflin Harcourt, 2007.

Evans, Arthur. *National Wildlife Federation Field Guide to Insects and Spiders & Related Species of North America*. New York: Sterling, 2007.

Evans, Arthur. *National Geographic Backyard Guide to Insects and Spiders of North America*. Washington, DC: National Geographic, 2017.

Evans, Arthur. *National Geographic Pocket Guide to Insects of North America*. Washington, DC.: National Geographic, 2016.

Phillips, David M. *Insects of North America: A Field Guide to Over 300 Insects*. New York: Falcon, 2019.

COMMUNITY SCIENCE RESOURCES

Bumblebee Watch (www.bumblebeewatch.org):

A program designed to track and conserve North America's bumblebees. It relies on information collected by citizen scientists, and you can help too!

The Lost Ladybug Project (www.lostladybug.org):

This program is designed to monitor ladybugs and help us better understand why some ladybug species are declining.

School of Ants (www.schoolofants.org): A program designed to study ants that live in urban areas, particularly around homes and schools.

Glossary

Abdomen The last and usually the longest or largest section of an insect's body. It contains the reproductive, digestive, and excretory systems.

Antennae Two segmented structures off the head that help with smell, taste, touch, and orientation.

Arthropods An invertebrate animal that has an external skeleton, a segmented body, and jointed appendages such as legs and antennae.

Castes Groups within a colony of social insects (such as honey bees) that look different and have different roles or functions in the colony.

Complete Metamorphosis The process by which insects that pass through four distinct stages when developing: egg, larva, pupa, and adult. (Butterflies are an example.)

Compound Eyes Large complex eyes (for vision) that are made up of hundreds of tiny individual lenses.

Desiccation To dry out due to the loss of water.

Entomology The scientific study of insects.

Exoskeleton An insect's hard (or generally hard) outer body covering, which provides protection and support.

Head The first of three main sections on an insect's body, consisting of eyes, mouthparts, and two segmented antennae.

Herbivores Organisms that feed on plants.

Incomplete Metamorphosis The process by which insects that pass through three distinct stages when developing: egg, nymph, and adult. (Grasshoppers are an example.)

Insects The largest and most diverse group of arthropods. They can be separated from other arthropods by having a three-part body consisting of a head, thorax, and abdomen.

Mouthparts Structures on the head that enable insects to feed.

Mandibles Hard, jaw-like structures of the mouth-parts that are adapted primarily for biting or chewing.

Niche The role an organism plays in the ecosystem.

Osmeterium A bad-smelling forked organ that swallowtail caterpillars can use to defend themselves.

Parasites An organism that lives on or in another organism, using it for food.

Parasitoids Organisms that live in or attach to the bodies of other organisms, primarily insects and arthropods, eventually killing them.

Predators Organisms that capture and feed on other organisms.

Proboscis The long, tongue-like mouthparts of an insect. These mouthparts are typically found in butterflies and moths and are used for sipping liquid food, such as flower nectar.

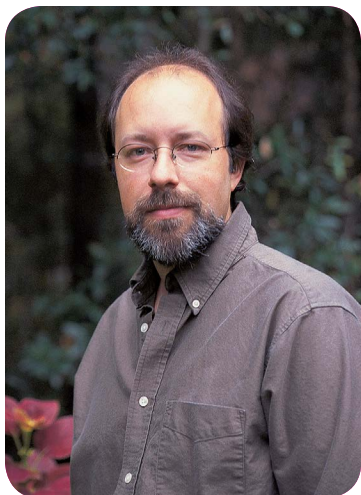
Scavengers An organism that feeds on dead organisms.

Spiracles A series of small holes along the sides of an insect's body, which it uses to breathe.

Thorax The second of three main sections of an insect's body. The thorax supports structures that enable the insect to move; these structures include three pairs of legs and one or two pairs of wings.

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About the Author

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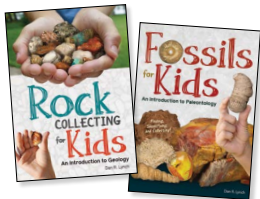


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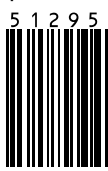
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