MEET THE NEIGHBORS!

COMMON INSECT GROUPS

More than a million insect species have been discovered on Earth and divided into commonly understood scientific categories. Scientists estimate there are 5 million to 10 million more insect species still to discover!

Scientists use a system called *taxonomy* for dividing living things into groups or categories. In basic taxonomy, the smallest group of closely related individuals is called a species, and the groups get bigger from there: genus, family, order, class, phylum, and kingdom. For example, the taxonomic species name for the insect that gardeners may know as the common eastern bumble bee is *Bombus impatiens*. Its genus is *Bombus*. (The species name always starts with the genus name.) *Bombus impatiens* belongs to the family Apidae, order Hymenoptera, class Insecta, phylum Arthropoda, and kingdom Animalia.

There are about 30 orders in the taxonomic class Insecta, depending on which taxonomist is doing the classifying. The number of orders has changed over time and will likely continue to as new DNA evidence shows that groups that look alike aren't as closely related as scientists once believed.

Some orders are highly specialized, such as the ice crawlers (order Grylloblattodea) that only live in caves or under glaciers. Others, like Coleoptera, the beetles, include tens of thousands of species that live in aquatic or terrestrial habitats.

This lesson will introduce you to five insect orders (see the table) that are common in Michigan: Coleoptera, Hemiptera, Hymenoptera, Odonata, and Orthoptera.

COLEOPTERA

With more than 400,000 named species, Coleoptera (beetles) is the largest insect order, and about 4,300 of them are found in Michigan.

All beetles have hard abdomens, called *elytra* (singular, *elytron*). The *elytra* are modified forewings that cover and protect the hind wings. All adult beetles have chewing mouthparts, but they feed on a variety of food sources. They may

ORDER	COMMON EXAMPLES	MOUTHPART TYPE	METAMORPHOSIS TYPE
Coleoptera	Lady beetles, ground beetles	Chewing	Complete
Hemiptera	Plant bugs, stink bugs, aphids, cicadas	Piercing-sucking	Simple
Hymenoptera	Ants, bees, wasps	Chewing (some species also have piercing-sucking mouthparts to collect nectar)	Complete
Odonata	Dragonflies, damselflies	Chewing	Simple, but immature life stages live in water
Orthoptera	Grasshoppers, crickets, katydids	Chewing	Simple

Five orders of the class Insecta that are common in Michigan, along with the most common members of the order and their mouthpart and metamorphosis types.

Photo 2-1. Lily leaf beetle larvae (left) are soft-bodied and cover themselves with their own excrement to discourage predators. Flatheaded borers (center) are thin beetle larvae with enlarged, flattened heads. They feed on wood just under the bark of tree trunks and branches. Japanese beetle grubs (right) live underground and typically rest in a C shape. (Photos by, left to right: David Lowenstein, MSU; Steven Katovich, Bugwood.org; David Cappaert, Bugwood.org)

be predators, herbivores, fungus-feeders, or omnivores. Beetles include some of the best-known garden pests in Michigan such as the Japanese beetle, lily leaf beetle, and viburnum leaf beetle.

Beetle larvae have many different body types (Photo 2-1). You can find beetles in or on plants and wood, in the soil, or just walking around. Some beetles live most of their lives underground as grubs, the larval life stage, feeding on soil roots. Other beetle larvae are aquatic or may look like maggots and not move much. Lady beetle larvae (Photo 2-2) are black and orange, hang out on plant foliage, and feed on soft-bodied insects like aphids.

HEMIPTERA

Species in this order, sometimes called *the true bugs*, are named for the characteristics on different sections of each wing. The wings are membranous and clear toward the end of the abdomen, while their forewings are hard and leathery in the section closest to the thorax (Photo 2-3). Hemipteran adults are highly mobile and large numbers of them can gather on a single plant. True bugs have only four or five segments on their antennae and come in a variety of sizes and colors. Many that feed on plants rely on their green coloration to hide them from the other insects, birds, and animals that would like to eat them.

Photo 2-2. A lady beetle larva on a leaf is surrounded by aphids that will soon become its prey. (Photo by Whitney Cranshaw, Colorado State University, Bugwood.org)

The mouthparts of Hemiptera are modified into a straw-like appendage for ingesting food by piercing-sucking. The order Hemiptera includes major garden pests like aphids, leafhoppers, and four lined plant bugs. Some Hemiptera pest species like leafhoppers and aphids carry viruses on their mouthparts that they transmit from plant to plant when feeding.

Hemiptera also includes beneficial insects, such as predatory stink bugs and damsel bugs (the subject of Lesson 3) that feed on eggs and larvae.

Hemiptera also includes intriguing insects like cicadas, whose loud, attention-getting mating calls and fascinating life cycles make them frequent subjects of summertime news articles. Depending on the species, cicadas spend anywhere from 2 to 3 years (annual cicadas) up to 17 years (periodical cicadas) underground.

HYMENOPTERA

The defensive tactics of the ants, bees, and wasps that make up the order Hymenoptera are not always popular with humans, but we benefit from many of them anyway. For example, bees are some of nature's best pollinators. As they fly from plant to plant, seeking nectar and pollen, they pollinate fruits and vegetables for us to eat, and flowers for us to enjoy. Visit the Native Bee Habitat page on MSU's Michigan Pollinator Initiative site for advice on attracting bees to your backyard.

Outdoor ants may be merely a nuisance (sugar ants, pavement ants) or a genuine threat to your home's structure (we're looking at you, carpenter ants!) when they're indoors. But outdoor ants are experts at cleaning up seeds, dead

Photo 2-3. This adult plant bug (order Hemiptera) has an X-shaped pattern on its wings. (Photo by Darren Blackford, USDA Forest Service, Bugwood.org)

Photo 2-4. An adult imported pine sawfly (*Diprion similis*). (Photo by John Ghent, Bugwood.org)

or living insects, and other organic matter outdoors. Learn about some common ants you may meet on Cornell University's What's Bugging You? Ants web page.

Wasps are the largest group in the order Hymenoptera, with nearly 100,000 species globally and about 17,500 in the U.S. You may be most familiar with one of the social wasp species such as bald-faced hornets or yellow jackets, which humans are most likely to tangle with in the late summer and fall.

Though the nests of social wasps often have hundreds of worker wasps, most wasp species are solitary. Each species preys on a single type of insect and they typically aren't a threat to people.

You probably never notice the most common types of wasps because they're so small. Parasitoid insects are a unique group that lay their eggs in or on other insect eggs, larvae, or pupae. When the parasitoid eggs hatch, they eat the host organisms. Though most parasitoids are wasps, some flies are also parasitoids.

Sawfly adults look like wasps but lack the narrow space between the abdomen and thorax that is characteristic of wasps (Photo 2-4). Sawfly larvae look like caterpillars and chew on the leaves of trees and shrubs. You can tell sawfly caterpillars apart from butterfly and moth caterpillars by the number of prolegs (false legs) on the abdomens. Sawfly caterpillars have six or more prolegs, while caterpillars have fewer.

All Hymenopterans undergo complete metamorphosis. Their larvae don't move much and stay in the nest until they turn into pupae.

ODONATA

The order Odonata is made up of dragonflies and damselflies. About 170 species of Odonata are found in Michigan. These insects have large eyes, very short antennae, and complex patterns of veins on their wings. The wings of adult damselflies rest over the abdomen and are narrower at the base than the wings of adult dragonflies, which rest perpendicular to the abdomen.

Adult dragonflies and damselflies live on land and feed on flying insects like mosquitoes. They lay their eggs one by one in water, where the larvae live after hatching. The larvae prey on smaller aquatic insects.

ORTHOPTERA

"Insects that jump" is a good basic description for the order Orthoptera. Adult grasshoppers, katydids, and crickets all have large hind legs they use for jumping and thickened forewings they use to fly. Michigan has close to 140 species in this group of good jumpers.

One way to tell these jumpers apart is by their antennae. Katydids have antennae that are almost as long as their bodies. Grasshoppers have short antennae. Cricket antennae are between the other two in length. Crickets also have two appendages called *cerci* that stick out from the back of their abdomens (Photo 2-5).

Orthoptera undergo simple metamorphosis. Immature insects in this order closely resemble adults but lack wings. All Orthoptera species have chewing mouthparts and feed on plant foliage. They rarely gather in sufficient numbers to become plant pests in Michigan, so you can ignore them in your garden and yard.

Photo 2-5. A field cricket with two long, thin antennae sticking out of its head and two shorter, thicker cerci sticking out of the back end of its abdomen. (Photo by Joseph Berger, Bugwood.org)

WHAT'S NEXT?

Some orders in class Insecta are common (for example, Lepidoptera, or butterflies) and others (like Phasmatodea, or stick insects, or Psocoptera, called barklice), are found only under very specific conditions. Lessons 3, 4, and 5 will profile several beneficial insects and explain the important roles they play. Next up: An underground predator, the *Scarites* beetle.

FIND OUT MORE: REFERENCES & RESOURCES

The print and online resources in this list delve deeper into insect development and behavior.

Cornell Integrated Pest Management. (n.d.) *What's bugging you? Ants*. https://cals.cornell.edu/integrated-pest-management/outreach-education/whats-bugging-you/ants

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Mercer, N. (2020). *Insect parasitoids: Important natural enemies of pests*. University of Kentucky; College of Agriculture, Food, and Environment; Cooperative Extension Service. https://entomology.ca.uky.edu/018

Michigan Pollinator Initiative. (n.d.). *Native bee habitat*. Michigan State University. https://pollinators.msu.edu/resources/pollinator-planting/native-bee-habitat/

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Raupp, M. (n.d.). *Bug of the week*. https://bugoftheweek.com/

Singing Insects of North America. (n.d.). *Sample songs of crickets and katydids* [Sound samples]. https://orthsoc.org/sina/a00samples.htm

Smitley, D., & Davis, T. (2017). *Japanese beetle: Tips for your lawn* [Fact sheet]. Michigan State University Extension. https://www.canr.msu.edu/resources/japanese_beetle_tips_for_your_lawn

Crickets and katydids are well-known for their ability to produce noise by rubbing two body parts together (called *stridulation*). Crickets rub two of their wings together to produce sounds, which vary among species.

Grasshoppers, katydids, and crickets are relatively large insects, so their main insect predators are a small group of predatory wasps that feed the Orthoptera to their offspring.

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