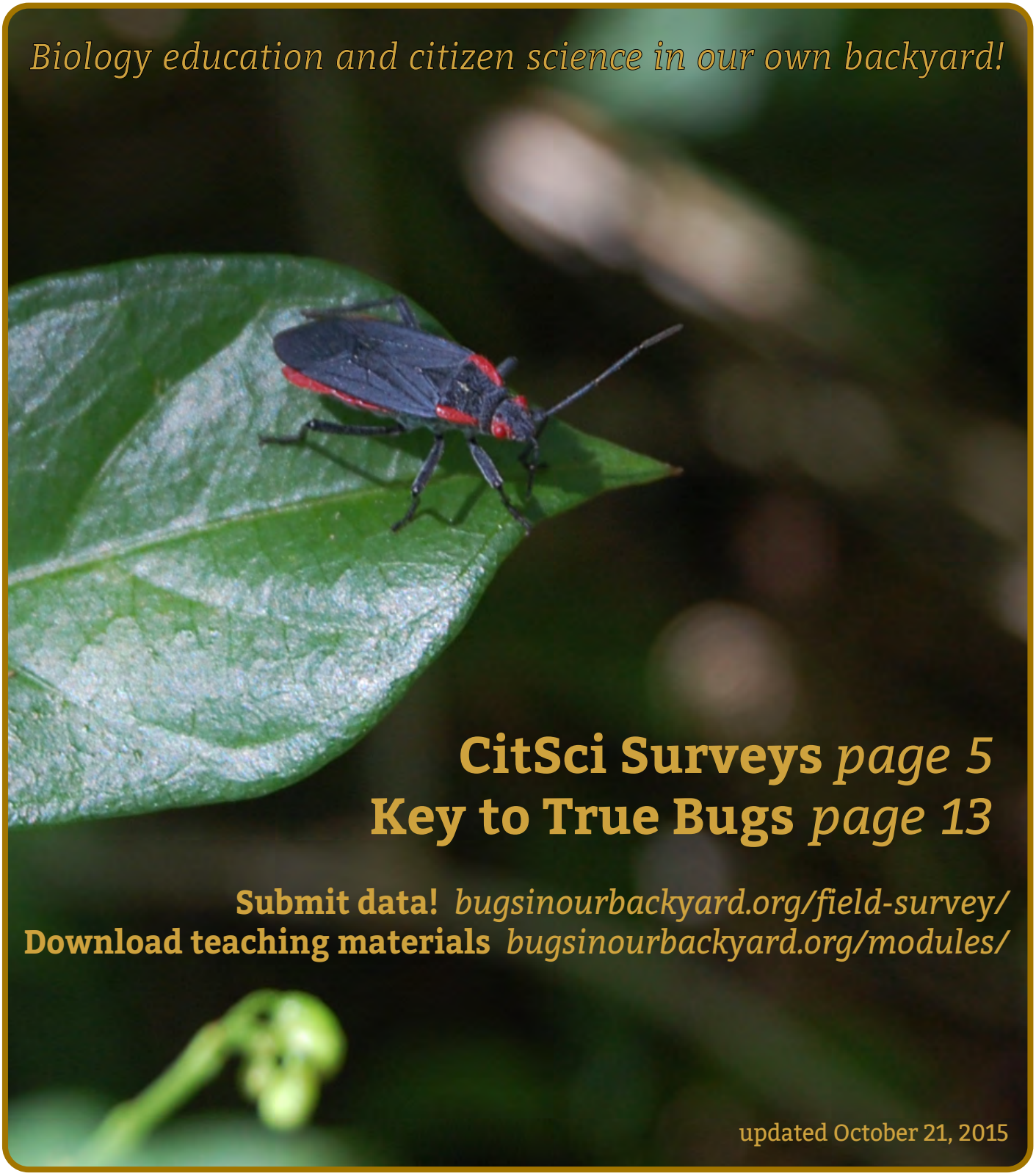
Bugs in our Backyard

Program Information and Field Guide



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Biology in our own backyard

An overview of the *Bugs in our Backyard* project

Bugs In Our Backyard is an educational outreach and collaborative research program, providing project-based learning opportunities for K-12 students– or anyone! The core activity for *BioB* takes advantage of the bugs in your own backyard, schoolyard or neighborhood. Students can become citizen-scientists by surveying this diversity of insects and plants.

A series of modular activities on different life science topics, such as biodiversity, growth and development, invasive species, genetics, insects, evolution, urban ecology and statistical analysis, are being produced. These modules can be scaled to the needs of different classes and grade-levels or used over multiple grade-levels.For older students, survey data are available to be used in hypothesis-testing or exploratory analyses. Teachers are encouraged to modify the activities to their own needs and share success stories.

BioB is part of an NSF-funded research program at Colby College, which will also provide students with insight into the practice of science. Our goal is to engage students with biology by making them citizen scientists. Get involved in ecological surveys of local bugs and their host plants.

These surveys are looking for answers to different biological questions. How do variations in wing development affect the range expansion of soapberry bugs? Do insects on milkweed crowd each other out? What differences exist in the boom-and-bust population dynamics of native boxelder bugs and introduced brown marmorated stink bugs? How does insect diversity vary over time? How does insect diversity vary across geographic and urban scales? These are some of the questions that can be asked. The data produced by the project contribute to a growing community database. Connect to the biological diversity in your own backyard!

The surveys target “true bugs” (what entomologists call Heteroptera) in the eastern US, but open-ended activities are also available. Everyone is welcome to get involved. Let’s expand what we know about about insect diversity across rural and urban landscapes!

Let us know what you find in your backyard!

Is your school in a city? Think your neighborhood is too urban for ecology or biodiversity? — Think again.

Project surveys

An overview of the *Bugs in our Backyard* project

Bugs in our Backyard allows you to contribute to on-going research on the distribution of insects in our communities. Several different surveys target different plant and insect species. So wherever you live, chances are, you can contribute to the project! Read the descriptions below to decide where you can best help gather data.

Golen raintree / Soapberry Bug Survey

he soapberry bug species *Jadera haematoloma* is one of the most interesting true bugs in America. These insects originated in Florida, along the Gulf Coast, and in isolated interior river valleys, where they fed on native plants in the soapberry family. Early in the 20th century, urban developers introduced the golden raintree (*Koelreuteria* sp.) from China, and *J. haematoloma* evolved rapidly to exploit this new food source. Golden raintrees have been planted in urban and suburban areas throughout the US, and the soapberry bugs have moved north following this human urban development. But there's a twist: not all soapberry bugs can fly! Many of them have short, non-functional wings.

By reporting the locations of golden raintrees, you can help us document the potential resources available to J. haematoloma. By reporting occurrences of the soapberry bugs– and telling us about their wing length– you can further help us understand how this variation in wing development helps or hinders their range expansion.

Boxelder Survey

The boxelder bugs, *Boisea trivittata* and *B. rubrolineata*, are native true bugs in the US that feed on the seeds of the boxelder or other maple trees (*Acer* sp.). These bugs are typically harmless to the trees that host them and pose no danger to humans. However, they can occasionally form huge aggregations with thousands of individuals at one location.

By reporting boxelder bug aggregations you can help us understand the boom-or-bust population dynamics of this species. Comparisons of these dynamics with those of introduced, invasive species, such as the brown marmorated stink bug may help us better understand how exotic species invade new areas.

Project surveys

Milkweed Survey

Milkweed is a common native plant that hosts a unique community of insects. These plants produces cardenolides, and relatively few insects have evolved the ability to tolerate this toxic chemical. Many of these insects internalize the cardenolide to defend themselves, and advertise their toxicity with bright colors. The iconic Monarch butterfly is one milkweed insect, as are several different species of true bugs and beetles.

Help us document the diversity of the milkweed insect community across the US!

Halomorpha Survey

The brown marmorated stink bug, Halomorpha halys, is a true bug that was introduced to the US from Asia. Away from its original predators, H. halys has proliferated. Besides being a nuisance in people's homes, these bugs can damage fruit and vegetable crops, as well as injuring ornamental plants.

If you have brown marmorated stink bugs in your area, help us record the extent of their spread and the plants they exploit. Understanding their invasion may help prevent future spread of these and other pests.

Open-Ended Survey

Perhaps you live in an area where the plants and insects mentioned above aren't found. There are still interesting insects in your backyard! This open-ended survey allows you to report any insects you might find and any associations they may have with plants.

By documenting the insects in your area you can provide important data on biodiversity. This information can be useful in studies of community ecology, species movements, climate change, and other questions we haven't even thought of yet!

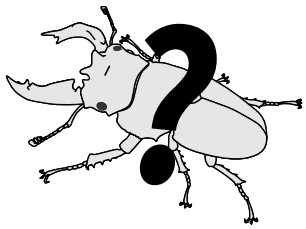
The data from all these citizen science surveys will be curated and posted publicly on our website. Besides data-gathering, your involvement as a citizen scientist can include data analysis. Think creatively about what these data can tell you, and let us know what you find in blog post comments or email.

How can I participate in citizen science?

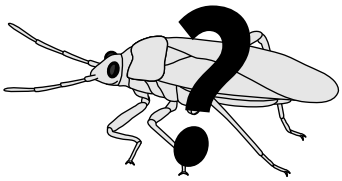
A quick guide to insects and plants targetted by the *BioB* ecological surveys

Wherever you live you will be able to find a diverse range of insects in your local area. What you find will depend in part on where you look, the time of year, and where exactly you live. The purpose of these guides is to help you identify these insects. We provide more detailed guidance for the species targeted by the citizen scientists of ***bugsinourbackyard.org***. Check out the website for more information and to submit your data to the project!

Start here! *What kind of plants or insect have you seen?*



I have an insect, but I'm not sure what it is...
If you have something interesting, but you're not sure if it's a "fly", a "bee", or a "beetle" (or even whether it's an insect), start with our guide to insect orders. ***p. 7***



I have a true bug, but I'm not sure which species...
Start with our key to the most common true bugs in eastern North America. You can also use these guides to confirm soapberry bugs, box elder bugs & milkweed bug species. ***p. 13***

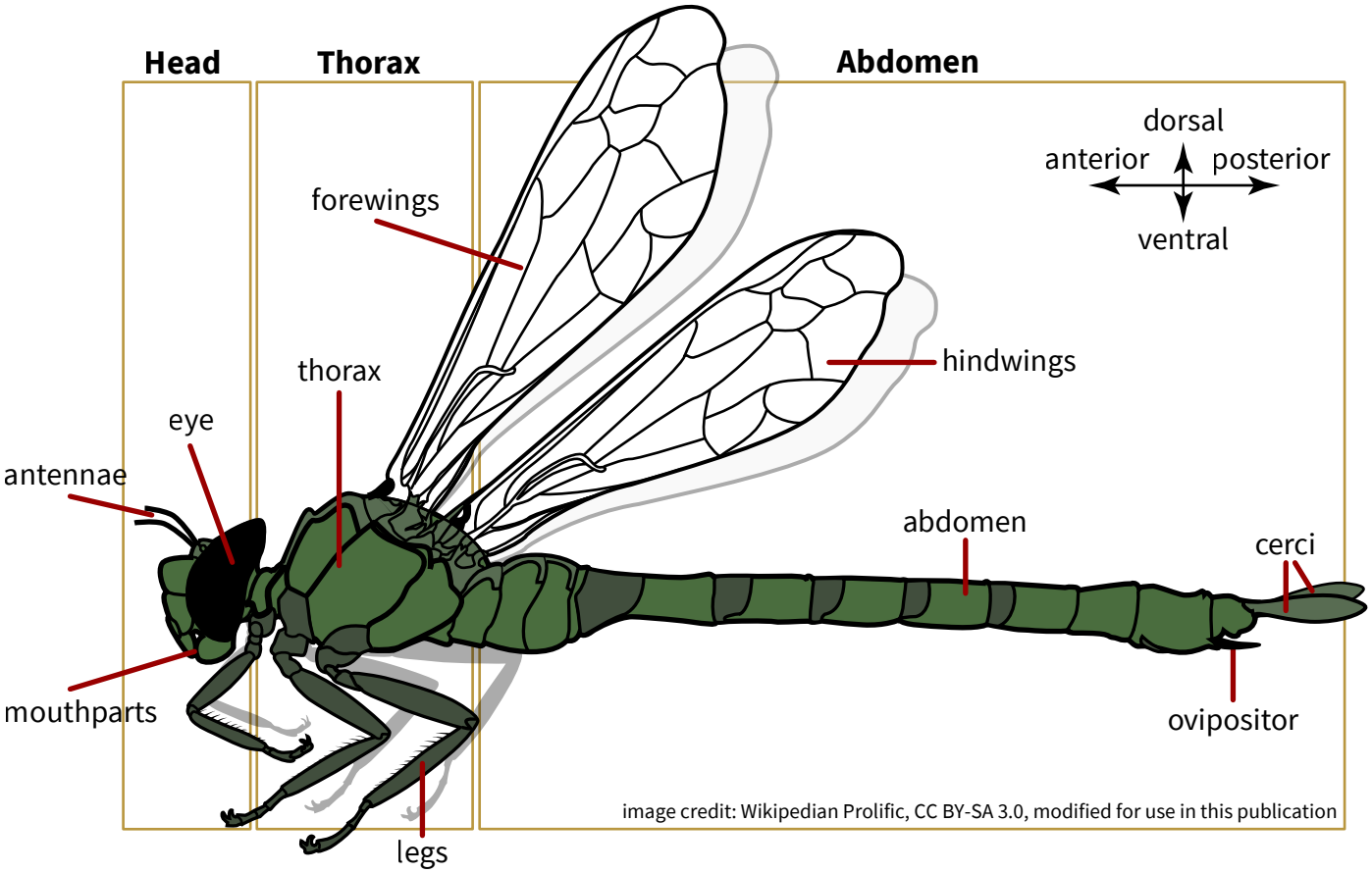
I have a maple or golden raintree...
Trees in the plant family Sapindaceae host a number of interesting insects, including true bugs such as soapberry bugs and box elder bugs. ***p. 15***

I have a community of insects on milkweed...
Milkweed can host many unique insects. Use our guides to identify the plant and insect species you find on the milkweed in your backyard! ***p. 21***

I have stink bugs!
Chances are if you've seen one, you've seen a hundred... Use this guide to distinguish native North American species from the invasive brown marmorated stink bug. ***p. 25***

What is an insect?

Insects are the most common athropods most people will encounter, and in terrestrial environments insects are critically important to the ecosystem. **Arthropods** are animals with a rigid external sketeton, and a body made of repeating segments. Some of these body segments have jointed appendages that have evolved to serve many different functions, including detection of chemicals, sound and movement (**antennae** and **cerci**), feeding (**mouthparts**), walking (**legs**),and flight (**wings**).

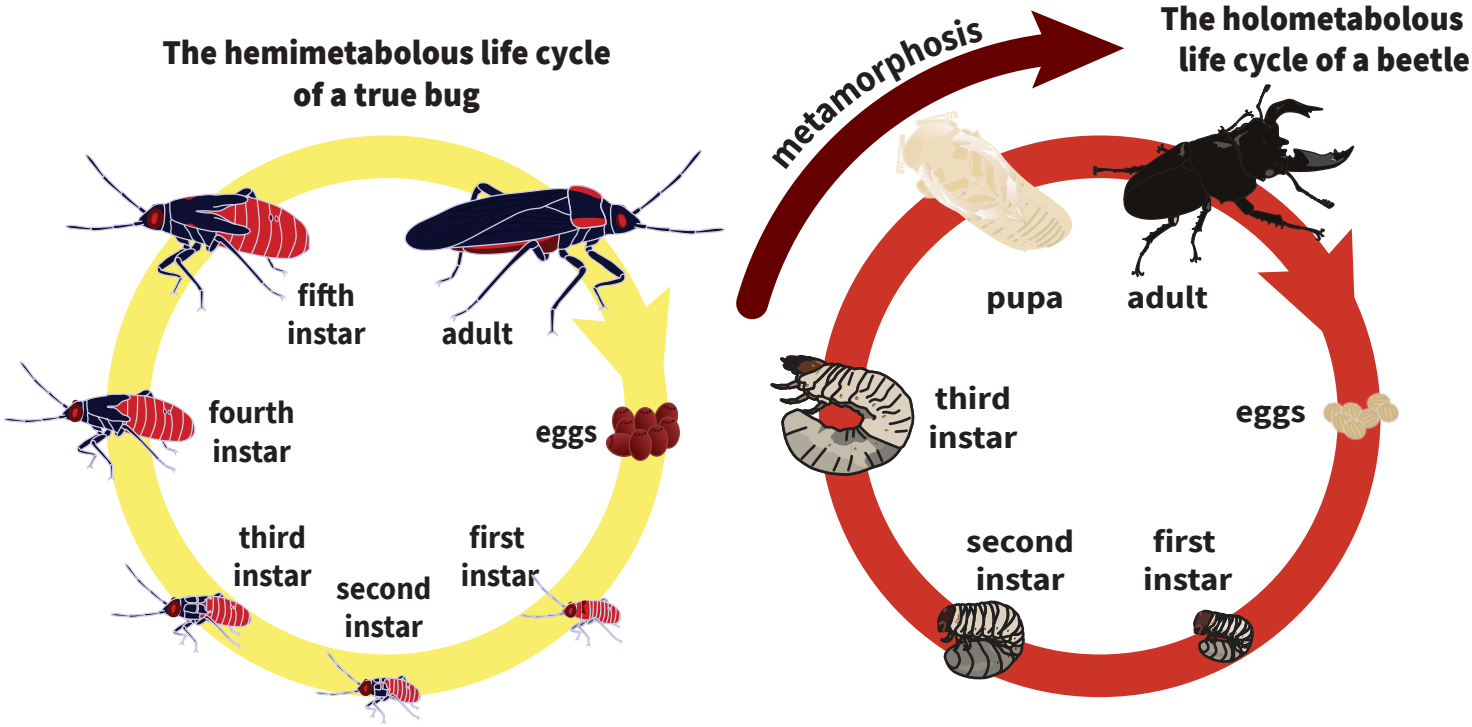


The bodies of all insects have three distinct body regions: a head, thorax and abdomen. The **head** has eyes and antennae for sensing the world and mouthparts for eating. The **thorax** has appendages used for moving around, such as legs and wings. Most adult insects have two pairs of wings. The **abdomen** contains most of the insect's organs. The abdomen often has no appendages, but there may be sensory cerci at the posterior. In some species, females have an appendage on the abdomen for laying eggs, the **ovipositor**. Similarly, males of some species have **claspers** used to hang on to females during mating. In many insect groups, the wings fold back to cover the abdomen when the insect isn't flying.

Insect life cycles

Some insects have a complete metamorphosis, while others do not

Some insects have evovled a dramatic **metamorphosis**. In these **holometabolous** insect species, juveniles looks very different from adults. Maggots, grubs, and caterpillars are juvenile flies, beetles and butterflies. They may look wormy, but they still have a distinct head, thorax and abdomen. During their metamorphosis, these insects form a resting **pupa**, **cacoon**, or **chrysalis**, which is often hidden or camouflaged. In contrast, **hemimetabolous** insects lack a true metamorphosis, and their juveniles resemble adults, but are smaller and have non-functional, rudimentary wings.



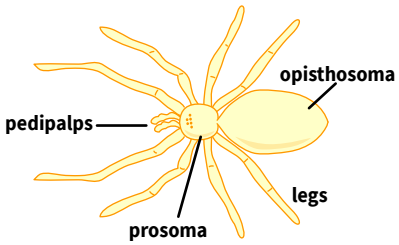
Each juvenile stage is known as an **instar**. During these periods, an insect eats and accumulates stored energy. While a growing insect can expand a little, it is limited by its rigid external skeleton. Therefore, insects must shed their exoskeleton in order to significantly increase their size. Each instar ends with a **molt**, the process where the insect sheds its skin and exoskeleton. The series of pictures below show a dragonfly juvenile (far left) molting to become an adult (far right). Adult insects never molt again!

image credit: Böhringer Friedrich, CC BY-SA 2.5, modified

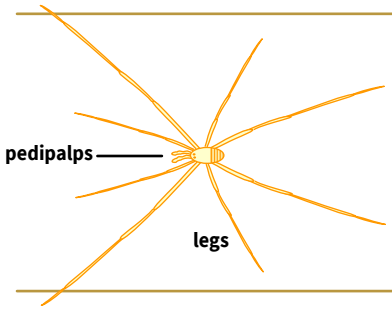
Things that are not insects

Some other arthropods in our backyard

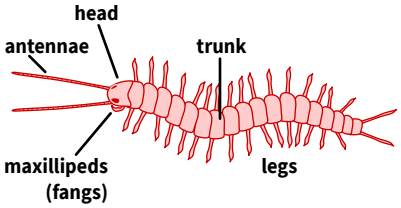
Insects are just one group of arthropods that have colonized land. Many other animals, like spiders, millipedes and isopods can be found in similar places, and these animals can be worth exploring too. However, it useful to know how to distinguish these creatures from one another. Here are some animals that are sometimes confused with insects. Notice the characteristics that make them unique.



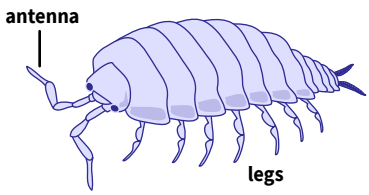
Spiders are arthropods with two body regions, a prosoma (sort of a combined head and thorax) and opisthosoma (or abdomen). Spiders can also be distinguished from insects because they have 8 legs and two pedipalps and two small chelicerae (or fangs) in front. Not all spiders spin webs!



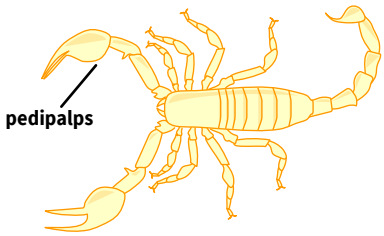
Daddy long-legs are relatives are the true spiders, however they make up a separate order called the Opiliones. Like true spiders, “daddy long-legs” or “harvestmen” have 8 long legs, 2 small pedipalps at the front and a pair of small chelicerae. They are not venomous and do not bite.



Centipedes and millipedes are easy to distinguish from insects because of their many legs! These arthropods can have venomous fangs, and they are often predators that hunt small insects and other arthropods in the leaf litter, under logs, and in basements.



Pillbugs, sowbugs, woodlice and roly-polies-- what ever you call them-- are isopods with 14 legs. They are mostly herbivorous crustaceans that have adapted to life on land. The females keep eggs and young in a pouch between their legs. Some species roll up into a ball to defend themselves.



Scorpions are distantly related to spiders, but they evolved independently to live on land. These arthropods can be distinguished from insects by having 8 legs, 2 large pinching pedipalps and 2 small chelicerae (fangs), and a long barbed tail. Tiny pseudoscorpions are similar, but have no tail.

Insect orders

Part 1 - Holometabolous insects

The list below covers insects that have complete metamorphosis. The larvae of these insects all look quite different. This guide should provide a quick visual reference, but for more detailed taxonomy and information check a more complete reference. Useful websites include bugguide.net, insectidentification.org, www.knowyourinsects.org, and our website bugsinourbackyard.org which focuses on true bugs.

Scientific name	Common name	Key Trait
Diptera	**true flies**	only 2 wings
Calliphoridae	**carrion flies**	often blue or green
Muscidae	**house flies**	
Tabanidae	**horse flies**	large biting flies
Nematocera	**midges**	tiny biting flies
Culicidae	**mosquitos**	mosquitos!
Syrphidae	**flower flies**	often hover in place
Tipulidae	**crane flies**	large (6cm)
Mecoptera	**scorpionflies**	scorpion tail
Siphonaptera	**fleas**	tiny blood-suckers
Lepidoptera	**moths, Butterflies**	Wings with tiny scales
Trichoptera	**caddisflies**	larvae make a case
Hymenoptera	**wasps**	narrow waist
	bees	bees: all sizes & color
Formicidae	**ants**	flightless
Megaloptera	**fishflies, etc.**	large mandibles
Neuroptera	**lacewings**	clear wings
Coleoptera	**beetles**	wings form a shell

Insect orders

Part 2 - Hemimetabolous insects

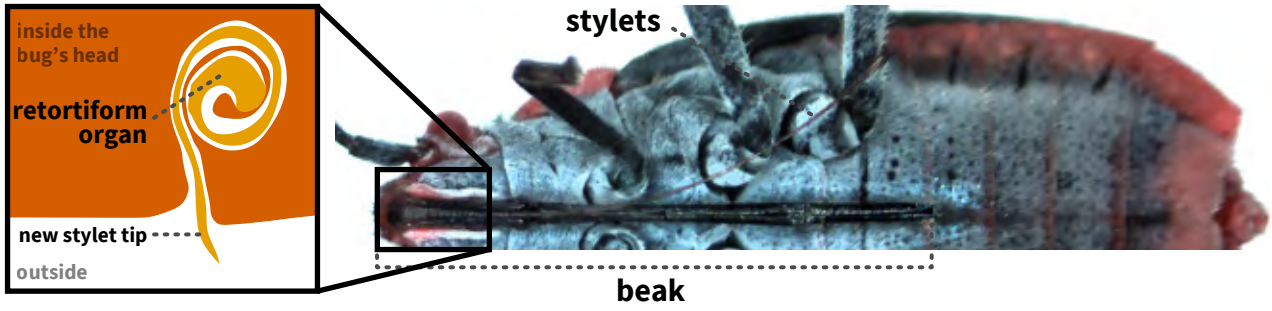
The juveniles of these insects mostly resemble the adults, but do not have wings. This guide should provide a quick visual reference, but for detailed taxonomy and information check a more complete reference. Useful websites include bugguide.net, insectidentification.org, www.knowyourinsects.org, and our website bugsinourbackyard.org.

Scientific name	Common name	Key Trait
Hemiptera		jointed beak
Heteroptera	**True bugs**	wings cross on back
Auchenorrhyncha	**Cicadas, leafhoppers, etc.**	wings sit side-by-side
Sternorrhyncha	**aphids, whiteflies, scale**	prolific plant pests
Thysanoptera	**Thrips**	tiny plant pests
Blattaria	**Cockroaches**	flat, omnivorous
Mantodea	**Mantises**	agile predators
Isoptera	**Termites**	wood eaters
Phasmida	**Walking sticks**	plant mimicks
Orthoptera		
Ensifera	**Crickets**	long, thin antennae
Caelifera	**Grasshoppers**	robust hindlegs
Tettigoniidae	**Katydids**	thin legs, leaf-shaped
Plecoptera	**Stoneflies**	large folded wings
Dermaptera	**Earwigs**	long posterior cerci
Odonata		long, thin abdomen
Zygoptera	**Damselflies**	wings held back
Anisoptera	**Dragonflies**	wings held to sides
Ephemeroptera	**Mayflies**	long thin cerci
Thysanura	**Silverfish & firebrats**	wingless, long cerci

Hemiptera

The true bugs and their reltives

The order Hemiptera include the true bugs (Heteroptera) and their relatives, the cicadas, “hoppers”, aphids, and other pests. Hemiptera have been around for at least 310 million years, and they are the 5th most species-rich order of insects. Hemiptera have unique mouthparts that form a jointed **beak**, which holds a set of thin **stylets**.



The beak holds and positions the bristle-like stylets, which peirce their food. The bug then injects saliva, and then sucks out a liquified meal. Four stylets zip together to form channels for saliva and food. The stylets must be shed at every molt, so the bugs constantly grow new ones, coilded inside their head, in a **retortiform organ**.

Heteroptera

true bugs

Heteroptera are the most ecological diverse of the Hemiptera. These exploit many different sources, such as toxic milkweed or soapberry plants. Many other species of Heteroptera are agile predators, such as water bugs, waterstriders and assassin bugs.

Auchenorrhyncha

cicadas, treehoppers, leafhoppers, and froghoppers

The screech of cicadas lets you know it’s summer! (They sing above 82˚F.) These insects hold their wings side-by-side, not crossed on their backs like the Heteroptera. All Auchenorrhyncha feed on plants and can be serious agricultural pests.

Sternorrhyncha

aphids, whiteflies and scale insects

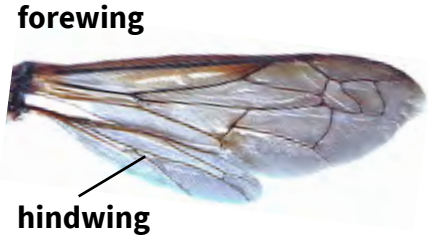
These insects also feed on plants. Some aphids and scale insects have become sedentary for part of their life cycle, and they can often be mistaken for a part of their host plant! Aphids can be important ecologically, where other insects eat their excretions as honeydew. Yum! (image: aroid, CC BY 2.0)

Heteroptera

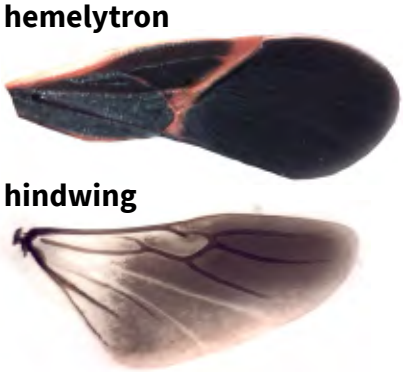
The true bugs

Heteroptera is a “suborder” within the order Hemiptera. These bugs are distinguished by the fact that they have forewings that have evolved a protective proximal half, and a membranous distal half. These special forewings are called **hemelytra**.

Wasp



True bug



Beetle

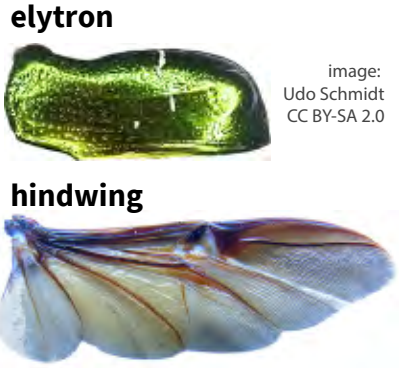


image: Udo Schmidt CC BY-SA 2.0

image: Schnobby, CC BY-SA 3.0

Gerridae
Waterstriders are predatory bugs specialized for live on the water’s surface.

Lygaeidae
Seed bugs will feed on leaves, stems, flowers and seeds of sometimes toxic plants.

Reduviidae
Assassin bugs hunt or ambush other insects, such as bees, beetles and caterpillars.

Rhopalidae
Scentless plant bugs do not produce a strong smell and feed on plants.

Cimicidae
Bed bugs and related species live exclusively by sucking the blood of mammals or birds.

Miridae, Larigidae
Plant bugs include species that feed on plants and other insects.

image: Lildobe, CC BY-SA 3.0

Pentatomidae
Stink bugs are a diverse group of plant-feeding bugs with defensive odors.

image: Giancarlodessi , CC BY-SA 3.0

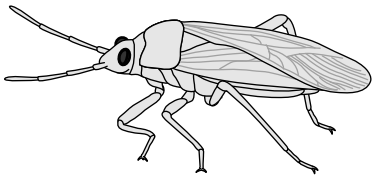
Coreidae
Leaf-footed bugs are a diverse group of mostly herbivorous bugs with big hindlegs.

Key to identification of common true bugs

in Eastern North America

by Trevor Fowles & David R. Angelini

What's that bug?



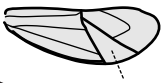
Does the bug have ocelli? (Secondary eyes on top of its head)

no ocelli — ocelli

cuneus

plant bug
Miridae
p. 15

Do wings have a cuneus? (Distinct triangular area)



cuneus

no cuneus

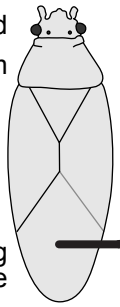
plant bug
Largidae
p. 15

orange or red border on pronotum & wings

red head red eyes

red cotton bug
***Dysdercus* sp.**

About how many veins in the wing membrane?



20 veins

4-5 veins

box elder samara

box elder bug
***Boisea* sp.**
p. 11

color on wings & middle of pronotum

no color on wings, (except light spots in rare species)

soapberry bug
***Jadera* sp.**
p. 14

black with yellow, orange or red; feeds on milkweed

red, black & white; feeds on asterids

black band across the middle of the wings

no black band, wings have orange or red X or)(shape

***Oncopeltus* sp.**
p. 18

***Lygaeus* sp.**
p. 18

white-crossed seed bug
Neacoryphus bicrucis

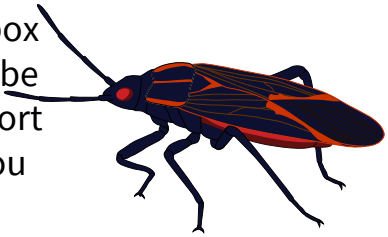
Maple and Box elder trees

Host plants of the boxelder bug

The genus *Acer* includes several species of maples and the box elder tree. These plants are now recognized as a part of the soapberry family, Sapindaceae. They produce **samaras**, flat seed pods that spin on the wind, commonly called whirligigs or helicopters. Individual species can be distinguished by the shapes of their leaves or samaras.

Acer negundo
Box elder

Below the bug icon indicates *Acer* species that are known to host box elder bugs. However, there may be other tree species that can support the bugs. So let us know what you find! bugsinourbackyard.org



Acer ginnala
Amur maple

Acer platanoides
Norway maple

image: Bff, CC BY-SA 3.0

A. pensylvanicum
Striped maple

Acer nigrum
Black maple

Acer griseum
Paperbark maple

Acer saccharum
Sugar maple

image: Virens, CC BY 2.0

Acer campestre
Hedge maple

Acer rubrum
Red maple

A. pseudoplatanus
Sycamore maple

image: Kobako, CC BY-SA 2.5

image: MRB, CC BY-SA 2.0

Acer palmatum
Japanese maple

Acer saccharinum
Silver maple

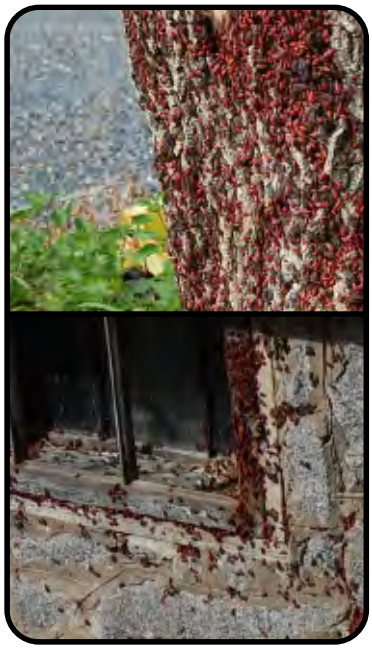
image: Than217 CC BY 3.0

A. buergerianum
Trident maple

Boxelder bugs

of North America

Boxelder bugs are distinctive insects, about one half-inch long. They feed almost exclusively on maples and boxelder trees, *Acer negundo*. They will suck sap from the leaves and young stems, but they prefer to eat the seeds. Boxelder bugs may also live on sugar or silver maple, and the soapberry, *Sapindus saponaria*. There are two species of box elder bugs native to North America, one on each side of the Rocky Mountains, and both are relatively common. These bugs can form huge aggregations of individuals in the Fall. Boxelder bugs look for sheltered places to survive the winter, and they often find their way into older houses, sometimes making a nuisance of themselves. The bugs are harmless to humans, and the best way to control them (if necessary) is to vacuum up the bugs, tightly seal up building s, and remove their food source.



Boisea trivittata

Eastern boxelder bug

Found in the United States from the Rocky Mountains to the Atlantic coast. It is thought that the species originated in the western part of its range, but has spread east. In addition to the box elder tree, *B. trivitatta* has also been found on Sugar Maple, Silver Maple and Trident Maple. It may be capable of surviving on other trees as well. Juveniles tend to be bright red, making aggregations very obvious.

Boisea rubrolineata

Western boxelder bug

Found in the United States and Canada, west of the Rocky Mountains. This species is very similar to *B. trivittata* except the veins of the proximal wing red. This species may also compete with the soapberry bug *Jadera haematoloma* for access to the golden raintree, *Koelreuteria paniculata*. The western boxelder bug tends to be less of a nuisance to humans than the eastern species, since it is less inclined to seek shelter in the winter months.

Sapinds

Plants of the soapberry family

Koelreuteria paniculata **Golden raintree** USDA Zone 5-9

Widely distributed in the US. Trees may reach 40 feet high.
Leaves: compound, pinnate, serrated edges
Flowers: yellow, 5 petals
Seedpods: conical outline.

Koelreuteria bipinnata **Chinese flame tree** USDA Zone 6-9

Found Missouri to southern New England and throughout the South.
Leaves: bipinnate (twice-compound), edges very finely toothed
Flowers: 5 petals
Seedpods: elliptical outline

Koelreuteria elegans **Chinese rain tree** USDA Zone 9-10

Limited to Gulf coast and Florida.
Leaves: bipinnate, leaflet edges are serrated
Flowers: 4 petals
Seedpods: elliptical outline

Sapindus saponaria **Soapberry** USDA Zone 9-11

Grows as a large bush or small tree. Native to the US Southeast and sheltered interior valleys of New Mexico, Texas and Oklahoma
Leaves: compound, pinnate, lanceolate (lance-shaped)
Seedpods: ball-shaped, 1.5-2 cm, glossy, leathery, 1 seed per pod

***Cardiospermum* sp.** **Balloon vine, faux persil, heartseed** USDA Zone 8-11

A perennial vine native to Florida, the Gulf Coast and Caribbean. Leaves are compound made up of 3 lots of 3 leaflets. Leaflets are toothed or lobed. Flowers are white and fragrant with 4 petals. Often grows up larger plants at the edges of clearings or road cuts. -- If you visit these sites, exercise caution with plants (and bugs) you find, since these habitats are increasingly rare.

Goldenrain trees are not native to North America, but they have been planted in many cities and towns. In the spring and early summer, these trees stand out with sprays of bright yellow flowers, which develop into golf ball-sized pods. The pods mature in late summer and fall to a gold or red color. *Koelreuteria* will drop their leaves in winter, but fallen leaves, seedpods or seeds may identify the trees. The seeds are 4-5 mm (1/4 inch) across, black with a small white spot. They look a bit like big peppercorns. Mature trees normally produce hundreds of seeds each year, and they can be found in grass or mulch even in trees are heavily landscaped.

Clockwise from upper left: a small goldenrain tree in Frederick, MD in late October; a goldenrain tree in bloom in August outside Denver, CO; a close-up of seeds and soapberry bugs on a ground cover of wood mulch; close-up of *K. paniculata* bark. (Images: David R. Angelini, CC BY-SA 4.0)

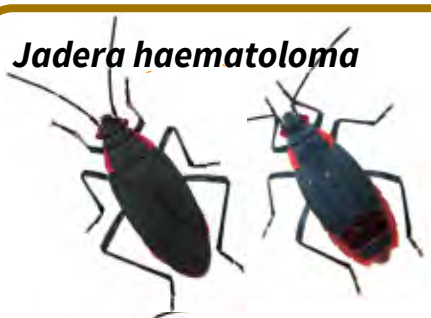
Soapberry tree and seedpods (images: David Eickhoff, CC BY 2.0; Wendy Cutler, CC BY 2.0)

Soapberry bugs

of North America

Soapberry bugs of the genus *Jadera* can be found in many temperature areas of the US. Outside of Florida and the Gulf Coast, *Jadera haematoloma* is the only species known to occur. These bugs will often form large aggregations on host plants. Short-wing adults are known from *J. haematoloma* and may occur in other species. Some individuals can be strong fliers, turning up in remote locations, away from host plants.

Jadera haematoloma



red-shouldered soapberry bug
Commonly found on the ornamental tree *Koelreuteria*. On native host plants, it occurs along the Gulf of Mexico, in South Florida, and in sheltered interior valleys. Long- and short-wing adult morphs can be found.

Jadera hinnulea

fawn-speckleded soapberry bug
Found in Florida, Texas, Mexico and Central America. Similar to *J. coturnix*, but covered in relatively fine spots and relatively short, white bristles.

Jadera coturnix

quail-speckleded soapberry bug
Occurs from Florida, the Carribean and Mexico to Argentina. Individuals may vary widely in size and color. Typically bown with dark spots.

Jadera sanguinolenta

blood-colored soapberry bug
Found in Florida and the Carribean. Similar to *J. coturnix* but showing more red, especially on the pronotum and meso-notum. The wing membranes typically lack spots.

Jadera antica

small soapberry bug
Found in Florida and the Carribean. Red to reddish-brown. No spots. Wing veins are shiny.

Plant bugs

The true bug families Miridae and Largidae

Plant bugs are...

blah
blah

Milkweed

A toxic plant hosting a unique insect community

Milkweed is a common plant throughout the United States and other parts of North America. It can be cultivated as an ornamental plant, but it will grow wild in disturbed habitats, such as feilds, empty lots and road sides. Milkweed can be recognized by bright clusters of flowers, or by its seedpods which have fluffy coma to dispurse seeds. The plants are named for a milky sap that is released from broken stems or leaves.

Milkweed has evolved its characteristic sap to deter herbivores. It contains a natural latex, which can be thick and sticky to trap would be plant-eaters. Milkweed is also poisonous. The sap contains toxic cardenolides, which can prevent muscle contractions in the heart. However, many insects have evolved resistance to cardenolide toxins, and these unique residents of the milkweed plant make up a highly specialized community. Amazingly, many of these insects store the cardenolide in their bodies, making them toxic to their own predators. The insects often advertize this toxicity with bright colors, such as the milkweed bug, *Oncopletus fasciatus*, and the milkweed beetle, *Tetraopes tetrophthalmus*. The monarch butterfly may be the most famous milkweed insect, and monarch caterpillars advertize their cardenolide toxicity with stripes of white, black and yellow.

There are many milkweed species in the genus ***Asclepias***, but only about a dozen are common in the eastern US.

Are leaves wide or narrow?

Wide
A. syriaca
A. purpuracscens
A. amplexicaulis
A. quadrifolia
A. variegata
A. rubra
A. humistrata

Narrow
A. tuberosa
A. incarnata
A. exaltata
A. viridiflora
A. curassavica

Needle-like
A. verticillata

Species with unique features

A. quadrifolia has 4 leaves per node.
A. verticillata has extremely narrow, almost needle-shaped leaves.
A. curassavica occurs only along the Gulf Coast and Carribean.
A. curtissii occurs only in Florida.

Milkweed species

A visual guide to common *Asclepias* of Eastern North America

There are 72 species of milkweed native to North America, although only about a dozen are found in the Northeast. This is a quick visual aide to identifiation, with the most common species at the top, less common species farther down.

Milkweed insects

Part 1

Lots of insects live on milkweed...


Danaus plexippus, monarch butterfly caterpillar


Danaus gilippus, queen butterfly caterpillar


Euchaetes egle, milkweed tussock caterpillar


Cycnia sp., tiger moth caterpillar


Bombus sp., bumble bee


aphids


Lygaeus kalmii, small milkweed bug


Lygaeus turcicus, false milkweed bug


Oncopeltus fasciatus, large milkweed bug


Largus succinctus, bordered plant bug


Pyrrhocoris apterus, firebug


Tetraopes tetrophthalmus, milkweed longhorn b


Labidomera clivicollis, Milkweed leaf beetle


Chrysochus auratus, dogbane beetle

Milkweed insects

Part 2

Lots of insects live on milkweed...


Syrphid, hoverfly


parasitoid wasp


Rhyssomatus lineaticollis, milkweed stem weevil


Oncopeltus cayensis, Eastern six-spotted milkweed bug


Oncopeltus sexmaculatus, six-spotted milkweed bug


Oncopeltus unifasciatellus, narrow-banded milkweed bug


Oncopeltus sanguinolentus, blood-colored milkweed bug


Oncopeltus aulicus, golden milkweed bug


scale insects


whiteflies

Stink bugs!

These bugs can smell but only some of them are invasive pests


image: USDA, CC BY 2.0

Stink bugs are a huge family (Pentatomidae) with several native species. Their smell comes from aldehydes. The brown marmorated stink bug (BMSB), *Halomorpha halys*, was introduced from East Asia in the late 90s. The first specimen was found in Allentown, PA, but it has spread throughout the Mid-Atlantic, the upper Midwest and has even appeared in Oregon. BMSB reproduce quickly with several generations per year. They often become a nusiance when adults look for warm places in houses and garages to overwinter. BMSB are a serious crop pest, damaging soybeans and fruit trees.

Halomorpha halys

Brown marmorated stink bug

BMSB are often found in huge numbers. But they can be confused with several native species. Firstly, BMSB are always brown-- never green. Their undersides are also a brown or tan color. Adults and juveniles are more mottled than native species, with coppery spots.

***Euschistus* sp.**


image: USDA, CC BY 2.0

Common brown stink bug

The native brown stink bug is also an agricultural pest, but their numbers don't reach the extremes of the BMSB. They can be distinguished by a fine saw-toothed edge to the pronotum (arrow) and their undersides are a light green. Juveniles are also light green.

Brochymena quadripustulata


image: cotinis, CC BY-NC-SA 2.0

Rough stink bug

This native stink bug has a longer head than the BMSB. The most obvious distinguishing feasture is a serrated shoulder (arrow). This part of the body behind the head is called the pronotum. These insects have a mixed diet. Feeding on some fruit and ornamental trees, as well as caterpillars.

Podisus maculiventris


image: Alberto Salguero, CC BY-SA 3.0

Spined soldier bug

This stink bug is a predator, which hunts caterpillars and beetle larvae. For this reason it is considered a beneficial insect in gardens and crop fields. The spined soldier bug gets its name from the pointed sides of its pronotum (arrow), which also distinguish it from the BMSB.

The people behind the project

Bugs in our Backyard is organized by David R. Angelini. Dave is an assistant professor in the Biology Department at Colby College, in Waterville Maine. He is interested in developmental genetic systems with alternative phenotypic outcomes, such as serially homologous, dimorphic and polyphenic traits. His work examines insect appendages as study systems and uses methods from functional genetics, morphometrics, endocrinology and genomics.

Colby College has suported the research and outreach activiteis of this project since its earliest days. Financial support from the Office of the Provost and the Division of Natural Sciences were essential in establishing the research foundations of *BioB*. Development and maintenance of bugsinourbackyard.org would not be possible without the generous assistance of staff from the Office of Information Technology Services including, Adam Nielsen, Ellen Freeman, and Randall Downer.

The development of *BioB* was shaped by conversations and helpful advice from many people, including Scott P. Carroll, Trevor Fowles, and Jamie Vernon.

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Bugs In Our Backyard

Field Data Record

updated 10/16/2015

1. Name _____

2. Date _____

3. School _____

4. Site address _____

Give the street address if known, or give the street name and nearest crossing streets

5. City & State _____

6. Latitude & Longitude _____

Use a GPS device or smartphone app. Give coordinates to at least 4 decimal places, e.g. 38.8802, -77.3965

7. Description of the field site _____

For example is the location a park, empty lot, sidewalk, parking lot, residential yard, etc

8. How urban or rural is the site?

- ○ Metropolitan
- ○ Urban
- ○ Suburban
- ○ Rural
- ○ Wild land

9. Host plant identification _____

Refer to *BioB* Field Guide for host plant identification

10. Number of host plants at this site _____

11. Trunk circumference _____

Please use centimeters 1 inch = 2.54 cm

12. Estimate the height of the host plant _____

Please use meters 1 foot = 0.3048 m

13. Estimate the width of the host plant _____

14. What is the condition of the host plant?

- ○ The plant is dormant (no live leaves)
- ○ The plant is in flower
- ○ The plant has developing seed pods (that aren't ripe)
- ○ The plant has mature seed pods

15. What is the groundcover? _____

What covers the ground at the plant's base? This might be leaf litter, grass, wood mulch, pavement, etc.

> Take a picture of the host plant

What bugs do you find on the host plant? (If there are too many to count, use a 1-m^2 (or 0.25-m^2) quadrat at the base of the host plant)

16. Bug species present _____
    Refer to the *BioB* Field Guide for help with insect identification.

17. Number of adult bugs _____
    Is this number is an exact count ☐ or an estimate ☐ ?

18. Number of short-winged bugs _____
    This is important for soapberry bugs, but may not be relevant to other species.
    Is this number is an exact count ☐ or an estimate ☐ ?

19. Number of juveniles _____
    Is this number is an exact count ☐ or an estimate ☐ ?

20. Behaviors (check all that apply)

- ○ Walking (They move if you approach them)
- ○ Flying
- ○ Eating seeds
- ○ Eating leaves on the plant
- ○ Eating from plant stems
- ○ Eating other bugs!
- ○ Eating carrion (such as dead insects)
- ○ Mating
- ○ Hiding under tree bark or leaf litter
- ○ Dormant (They just sit there unless I touch them!)

21. Other comments about the bugs, host plants, or location _____

_____

_____

_____

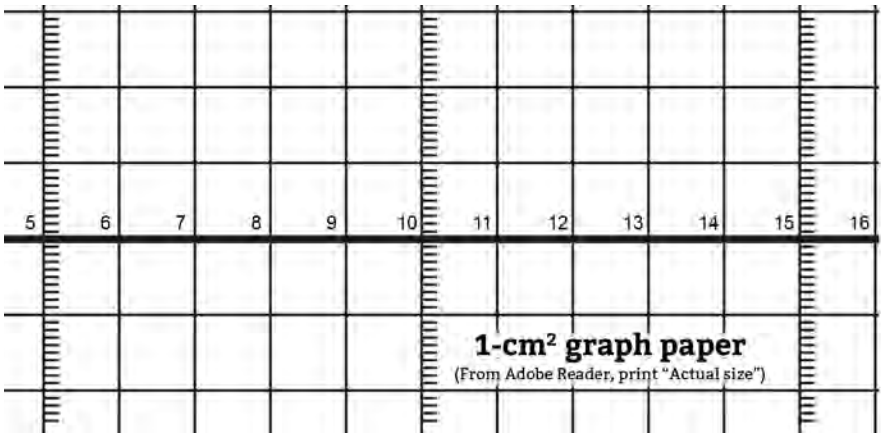
_____

_____

> Collect up to 12 adult bugs. Place each bug in a clear Petri dish, on a 1-cm^2 grid. (This can be done in the field or later in the classroom.)

> Photograph each bug from the dorsal (back) side.

> Photograph each bug from the ventral (bottom) side. (Just turn the dish over. The bug will cling to the dish, if it's not too agitated.)



Detailed instructions

Thank you for contributing to *BioB*! We welcome all data entries. While more complete submissions may be more helpful, you can make a survey submission even if many of the items are omitted. For repeated data collection, you can print the previous two pages, but refer to these instructions for detailed explanations of each item.

1. **Name** - This is the name of the individual or group of people collecting the data. If anyone has privacy concerns, full names aren't necessary. A first name, pseudonym, or teacher's name could be used instead.
2. **Date** - The date when the data were collected, not the date when the data are being uploaded to bugsinourbackyard.org!
3. **School** - If you are contributing to surveys as part of a school program or class, please let us know your school's name!
4. **Site address** - Give the address where the data were collected. If your unsure of the numbered street address, you can list the street name and the nearest blocking streets. For example, "Main St. between School St. and Elm St." Alternatively, name the location of the site, such as "City Hall."
5. **City & State** - Where were the data collected? This item is required for online submission, since it provides the minimum geographic information to make the other data useful.
6. **Latitude & Longitude** - If you have access to a GPS device, record this information from the site. However, there are many free apps for smartphones that will give you lat & long coordinates. *LL Latitude Longitude Coordinates* is a simple app for Android phones that works well. Free apps for iPhone include *Coordinates* and *Latitude and Longitude Plus*. Alternatively, if you take careful note of your street address or other landmarks near the site, you can get lat & long coordinates by simply clicking on the site in GoogleMaps. (From MapQuest, right-click to see a window with coordinates.)
7. **Description of the field site** - This is meant to be a short description of environment. Is it a park, golf course, empty lot, sidewalk of a busy street, residential yard, edge of a parking lot, or something else?
8. **How urban or rural is the site?** - The four-point urban-rural scale is used by ecologists to loosely categorize locations. While this scale is inherently subjective, here are some guidelines.
    - Metropolitan describes cities with more than 1,000,000 residents.
    - Urban describes towns or cities with more than 100,000 residents. The term could also be applied to particularly dense central areas of small cities.
    - Suburban describes towns or cities with 10,000 to 100,000 residents
    - Rural describes towns with fewer than 10,000 residents. The term could also be applied to thinly settled or undeveloped areas of small cities, often on the edge of the municipality.
    - Wild land includes completely undeveloped wilderness, as well as open countryside.

9. **Host plant identification** - List the name of the plant associated with the insects you are reporting. You can also report the locations of common host plants, even if *no* insects were found. Use the Latin name if possible, but common names can be given instead. If you're not sure of the identification, just make your best guess! The *BioB* Field Guide is one resource, but you can use any guide book to help identify plants or insects. A few helpful websites for plant identification include leafsnap.com and gobotany.newenglandwild.org. If your site has multiple plants, one can record all of them on this sheet, but please make separate data form submissions on bugsinourbackyard.org.

   If you've found insects that are not on or near a plant, then simply ignore all the items related to host plants.

10. **Number of host plants at this site** - A field site should be considered a group of plants all within close walking distance of one another. If a line of trees covers a mile of one road, provide this detail in the comments, but it might be best to limit your survey to one or a few trees.

11. **Trunk circumference (in centimeters)** - Use a flexible measuring tape to find the circumference of the trunk. For trees, take this measurement 1 meter up the trunk from the ground. If the trunk branches near this height find a more representative spot close by. If the tree has several trunks of branches a lot, you can measure a representative one and report the number of branches. For example, "3x50cm". If the plant is herbaceous, such as milkweed, simply ignore this item from the survey. If you don't have a metric measuring tape, you can record the data in inches, but please convert to cm before submitting the data online.

12. **Estimate the height of the host plant (in meters)** - Typically this is done by eye. Some comparisons: A basketball hoop is 10 feet (3.05m) high. For most residential buildings, the first floor is 4.65 m high and upper floors add 3.1m. For office buildings, the ground floor is typically 7.8m and upper floors add 3.9m each.

13. **Estimate the width of the host plant (in meters)** - Again, estimate this by eye. However, you may also be able to find large trees on GoogleMaps or other satellite-based mapping apps, where you can compare the tree's width to the map's scale for a more accurate estimate.

14. **What is the condition of the host plant?** - Check off each of the boxes if the plant is dormant (no live leaves), has opened flowers, unripe fruit or seedpods, or mature fruit or seedpods.

15. **What is the groundcover?** - What can be found at the base of the tree or plant? Depending on your location this might be fallen leaves (leaf litter), grass, wood mulch, crushed stone, pavement or something else. Include all materials within about 1 meter of the plant.

> **Take a picture of the host plant** - A picture is important to help *BioB* staff confirm your identification of the plant. Try to include key diagnostic traits, this leaves, flowers, seeds, or bark texture. Up to 3 pictures should be uploaded with the data submission form on bugsinourbackyard.org.

16. **Bug species present** - Identify the insects you find as precisely as you can. Some insects are very hard to identify to species, even for professional entomologists! The *BioB* Field Guide provides a key and visual guide to some common species of true bugs and species of special interest. It also includes a guide to orders of insects. This level of description covers broad categories of insects, like flies, beetles, grasshoppers, etc. While this degree of identification might seem less satisfying than a species-level ID, the information is still very valuable in a landscape-scale ecological survey like ours!
17. **Number of adult bugs** - If you find a small number of insects, count them all. However if you find a mass aggregation of insects, which is often the case for soapberry bugs or box elder bugs, you can estimate the number. One way to do this is two count the number in a small representative area, using a quadrat (a square made of wood or plastic for which you know the area--typically 0.25 square-meters), then multiply by the estimated area the insects cover. Importantly, check off if your number is an exact count or an estimate.
18. **Number of short-winged bugs** - This item is most important is you find soapberry bugs, where the number of short-wing and long-wing bugs is a focus of research. Be sure not to mistake juveniles for short-winged adults.
19. **Number of juveniles** - Typically smaller and wingless compared to adults.
20. **Behaviors** - What are the insects doing?
    - Do they actively walk around?
    - Did you see them, but them some or all of them flew away?
    - Are they eating seeds or fruit of the plant they're on?
    - Are they eating leaves on the plant?
    - Are they eating stems or twigs on the plant?
    - Are they eating other bugs? This might include predation, as well as cannibalism.
    - Are they eating dead insects or other animals (carrion)?
    - Are they mating? With some insects, the male will hold on to the females back. For other insects, including true bugs, males and females will appear to be connected end-to-end during and after they mating.
    - Are they hiding under tree bark, leaves, or other debris on the ground?
    - Are they dormant? Do they just sit there unless you touch them? This may often be the case during winter weather.
21. **Other comments** - If there is anything you wanted to communicate that the format of this data sheet didn't allow for, just make note of it and let us know!

> **Collect bugs and photograph them** - Providing pictures of insects you've seen will help *BioB* staff confirm your identification. In some cases we may be able to provide more precise identifications, such as a species name rather than the just the insect's order. If you can't catch an insect, a picture of it "in the wild" is okay too, and may allow an identification.

Images are especially important for surveys of soapberry bugs, where we would like to get detailed anatomical information. Ideally, this should include 3 long-winged males, 3 long-winged females, 3 short-winged males and 3 short-winged females. Try to get pictures of the bugs at rest in a Petri dish, from directly above (dorsal) and directly below (ventral). Put a ruler or metric graph paper under the Petri dish to provide scale.

bugsinourbackyard.org

1-cm² graph paper

(From Adobe Reader, print "Actual size")