

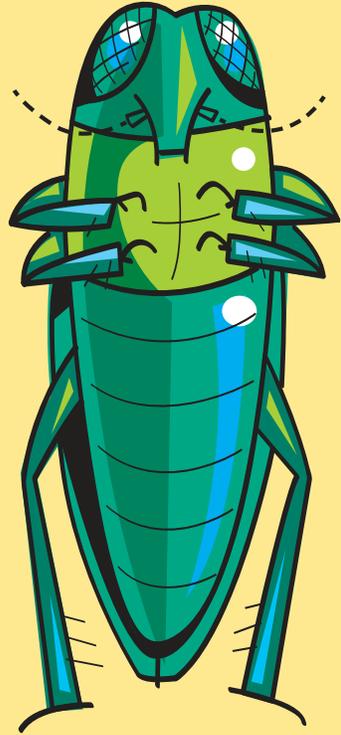
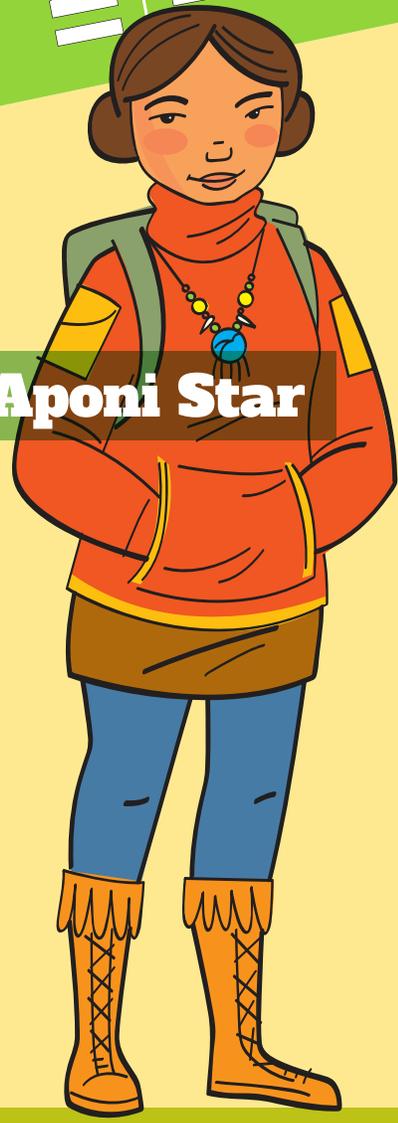


Help the Plant Heroes protect our forests
by slowing the spread of pests and diseases!

INSECT | EMERALD ASH BORER

PLANTHEROES.ORG
ADVANCED
ACTIVITY
BOOK

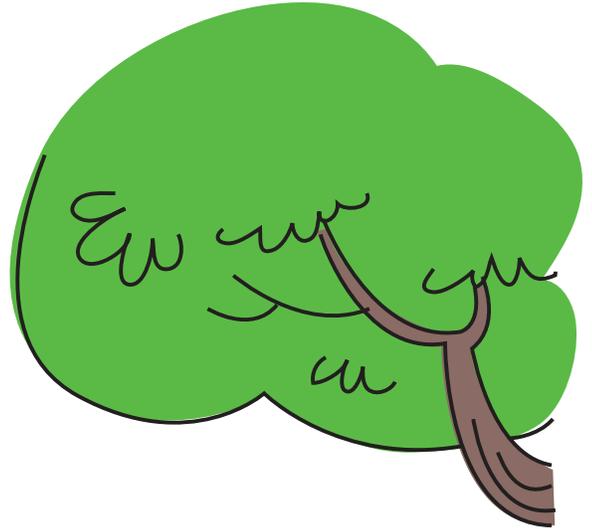
Aponi Star



BE A PLANT HERO!
Help Aponi slow
the spread of the
emerald ash borer!



Meet the PLANT HEROES!



LAURA WILKINS

From: Athens, Georgia
Hobbies: playing the trumpet,
gardening, studying ecology

FRANKIE BARKER

From: Shrewsbury, Massachusetts
Hobbies: climbing trees, camping

NATE GREEN

From: Tacoma,
Washington
Hobbies: going on
adventures, learning
about fungi

APONI STAR

From:
Southeast
Illinois
Hobbies:
learning
more about
entomology
(the study of
insects)



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The Plant Heroes are four friends who love spending time in nature more than anything else! They enjoy climbing trees, walking trails, and camping.

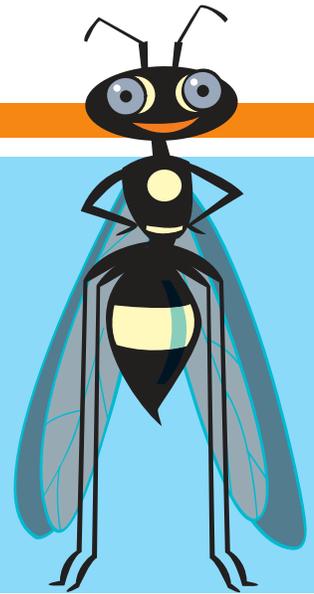
The heroes are learning about why our forests are in danger. There are insects and fungi that can impact trees, sometimes affecting the health of whole forests. Trees may become sick or die when they are weakened by an invasive species, a living thing that is introduced to a new environment where it can cause damage to existing organisms.

Follow Aponi to learn the story of how she slowed the spread of the emerald ash borer...





WASP WATCH



Aponi and her cousins were playing softball during a summertime family reunion picnic at a neighborhood park in Harrisburg, Illinois. While bored to death (nobody was hitting well that day!) she noticed a patch of small dirt mounds in center field.



After the game, she went back to inspect more closely, and realized that these were ground nests and eventually saw a small wasp entering the burrow. She took a picture of the bug and looked it up in her *Field Guide to Flying Insects of the Midwest* when she got home and learned that this was the famed species of wasp, *Cerceris fumipennis*, known for hunting emerald ash borer.

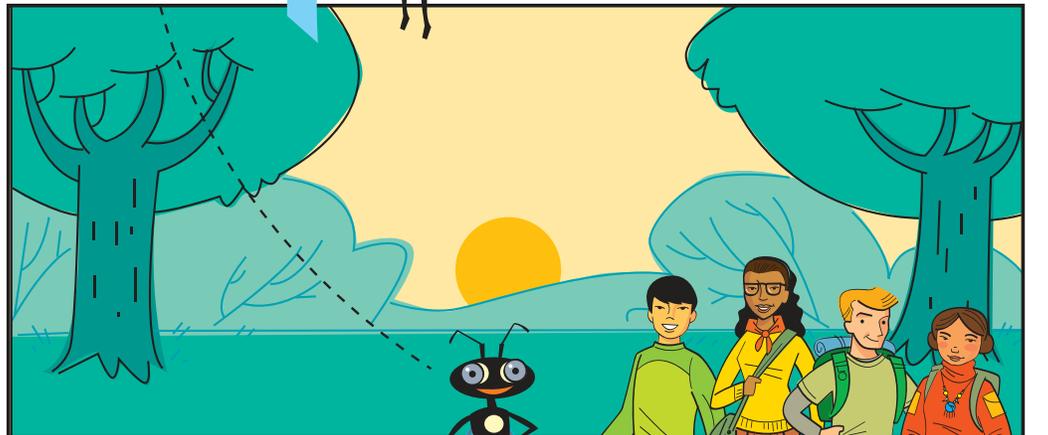


The Plant Heroes are brought to you by the American Public Gardens Association. This comic was developed with financial support from the USDA – Animal and Plant Health Inspection Service and reproduced with financial support from the USDA – Forest Service. Play games and learn how you can protect plants at plantheroes.org.



Aponi shared this finding with her county extension agent, who explained that using the wasp to track the location of emerald ash borer was called "biosurveillance" and put her in touch with her state's pest survey coordinator.

PLANT HEROES



The presence of the wasp in the area helped local officials find and remove a stand of infested ash trees (the first found in this part of the state) and prevent the borer from spreading into the nearby Shawnee National Forest!

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Meet the Beetle

The emerald ash borer is one cool-looking beetle! Unfortunately, ash trees in North America can be damaged by this insect. Emerald ash borers normally live in Asia but ended up in the United States, likely brought over in lumber (wood). They are considered an invasive species, which means they have been introduced to an ecosystem that they are not native to, and they have few or no natural predators to keep their populations in balance. Use this guide to learn how to identify the beetle by its appearance.

ELYTRON

flat, hardened wing for protecting the hindwings; usually metallic green

PRONOTUM

hardened plate; often green with a reddish or copper tint

ABDOMEN

red, purple, or magenta in color

HINDWINGS

delicate see-through wings used for flying



B

ANTENNA:
triangular
shaped sections

EYES:
large



HINT:

Insects have bodies that are divided into 3 segments: Head, Thorax (where the wings are located), and abdomen.



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PHOTO CREDITS: A: promiseminime, Flickr.com; B: David Cappaert, Bugwood.org

Far From Home

INVASIVE INSECTS have been transported from their native range (area) and brought to a different region or country (usually by accident). Without their natural predators, these species can multiply rapidly and throw an ecosystem out of balance. A species is considered invasive when it causes damage in these new territories.



The emerald ash borer arrived in the United States in 2002. In only 18 years, emerald ash borers were able to spread across the country and are now found in half of the states in the United States and many provinces in Canada.



Scan this QR code or type in this website to see just how quickly EAB can spread!
<https://bit.ly/EABdistributionmap>

When an environment insects live in is healthy, insects and plants can exist in harmony. All insects have roles in their home environment. These roles include pollinating flowers, which allow many plants to reproduce. Others help by eating old trees, which is nature's way of recycling materials. Can you think of other roles insects have in nature? Write them in the space below.

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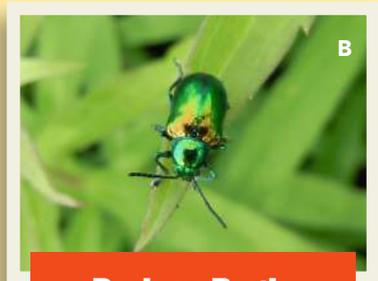
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NOT THIS BUG!

Emerald ash borer looks a little like these insects—don't get them confused!



Sixspotted Tiger Beetle



Dogbane Beetle



Bronze Birch Borer

PHOTO CREDITS: A: Katja Schulz, Flickr.com; B: US FWS, Flickr.com; C: Whitney Cranshaw, Bugwood.org



Lifecycle Maze



The emerald ash borer goes through several life stages (changes) during its lifetime. Adult beetles lay eggs on ash trees, and larvae hatch from those eggs. After eating parts of the ash tree, the larvae change into pupae, and finally into adults. Learn more about the lifecycle of the emerald ash borer by completing the maze below.



EGGS

A female adult beetle lays its eggs in a crevice in the bark of an ash tree. The eggs are shiny and caramel colored.

START

LARVA

The egg hatches into a white larva with a segmented body. The larva begins to eat a section inside the tree called the xylem, which is where the tree carries water up from its roots. With all the tunnels the larva creates, the tree is no longer able to drink!



PUPA

The larva becomes a pupa—the resting stage of the emerald ash borer. During the pupal stage, the emerald ash borer slowly changes into an adult.

ADULT

An adult emerald ash borer emerges and flies off in search of new ash trees.



HANDY TIP!

Add an "e" at the end of larva or pupa if you are talking about more than one larva or pupal!



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PHOTO CREDITS: A: Houping Liu, Bugwood.org; B: David Cappaert, Bugwood.org; C: David Cappaert, Bugwood.org; D: Leah Bauer, Bugwood.org

This Beetle's Favorite Trees

The emerald ash borer lives in and only feeds on, ash trees. The ash is known as the “host” tree for the emerald ash borer because the borers are the “guests.” All ash trees can be eaten by emerald ash borers. Look around in the woods, parks, or gardens near you and see if you can find an ash tree. If you can't go outdoors right now, look at the photos of an ash on page 4 & 5 in your field guide. Below, write or draw what you observe about the different parts of the tree. What are the colors, textures, shapes, and patterns you see?

IS IT AN ASH?

Use the checklist below to see if you've spotted an ash tree.

- Leaves, branches and buds are directly opposite from each other on the stems.
- Ash trees have 5-11 small leaflets that together make up one leaf!
- Young trees have smooth bark and older trees have deep ridges with diamond patterns.
- Seeds are held in papery, flat sleeves and hang in clusters or bunches, like bananas do.

TREE:

LEAVES:

BARK:

BRANCH AND BUDS:

Follow along on page 4&5 in your field guide for tips to identify an ash tree!



WHO WAS HERE?



The trees in North America don't have defenses against the emerald ash borer. When this beetle eats parts of ash trees, it causes visible injuries called "symptoms." If you find an ash tree with the following symptoms, it might be a clue that you have found an emerald ash borer infestation. Use your life cycle maze or field guide if you need clues to guess which stage of the beetle's life cycle relates to each of these symptoms. Some life stages may be used as answers more than once.



WORD BANK:

EGG
LARVA
PUPA
ADULT

1.

Woodpeckers like to eat emerald ash borers living in the tree during these two life stages and their pecking is a sign that larvae are present in a tree.



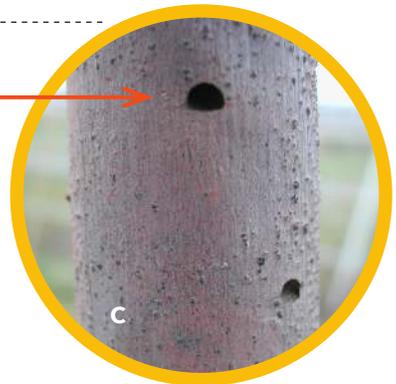
2.

These tunnels (called "galleries") are created by the insect in this life stage.



3.

The insect in this life stage exits the tree creating a hole shaped like a capital letter "D" on its side.



4.

This tree has grown leafy stems at its base which is a symptom of not getting enough water. The beetle may cause this kind of stress to the tree at this life stage.



5.

These trees are not getting enough water, and have dropped all their leaves to conserve water. At which life stage does the insect prevent the tree from taking up water through its roots?



Which life stage of the emerald ash borer are you most likely to see?

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PHOTO CREDITS: A, E: Steven Katovich, Bugwood.org; B: Kelly Oten, Bugwood.org; C: PA DCNR, Bugwood.org; D: Mich dept Ag, Bugwood.org

Crossword



WORD BANK:

INVASIVE

XYLEM

BUTTERFLY

ASH

WASP

ABDOMEN

LARVA

ADULT

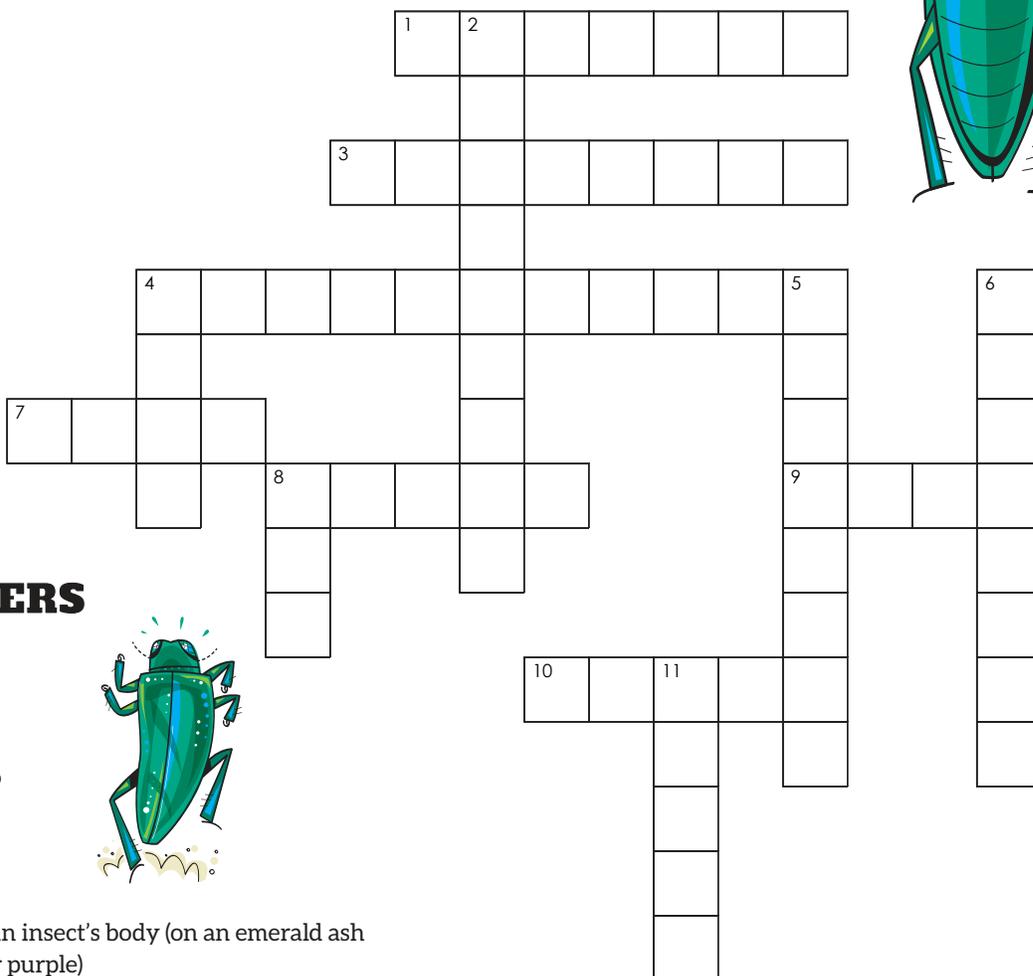
HOST

WOODPECKERS

PUPA

ANTENNAE

SYMPTOMS



ACROSS:

- The lower segment of an insect's body (on an emerald ash borer, it's usually red or purple)
- Long structures attached to the head of an insect that help it sense its environment
- Predators of the emerald ash borer that use their beaks to poke holes in the bark and find the insects
- An organism that an insect lives in and feeds on (hint: the insect is the "guest")
- In this life stage, the emerald ash borer makes D-shaped holes when chewing its way out of the tree
- In this "resting stage" of its life cycle, the emerald ash borer changes into an adult
- These cells in a tree trunk transport water and are damaged when emerald ash borers eat them

DOWN:

- An example of a helper insect that pollinates flowers
- An insect predator of the emerald ash borer that builds a nest on the ground
- Visual clues that a tree has been injured and is stressed
- A living thing (organism) that has been introduced to an ecosystem that they are not native to and has few or no natural predators to keep their populations in balance
- A tree with opposite leaves, papery seeds, and diamond shaped patterns on its bark.
- Early life stage of the emerald ash borer when it eats the xylem of trees

HOW DO PLANTS GET WATER?

Check out this video with a cool experiment all about how plants get water!
Scan the QR code with a phone or type in <https://bit.ly/howdoplantsdrink>



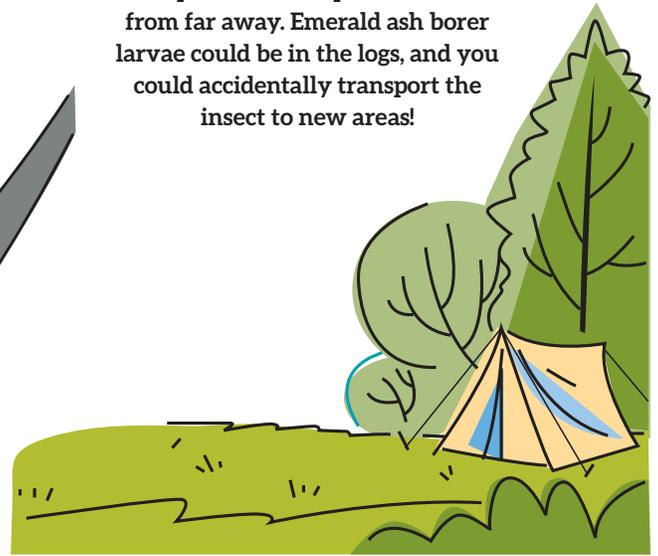
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SLOW THE SPREAD!

If you like to go camping, buy your firewood only near where you camp—never transport firewood from far away. Emerald ash borer larvae could be in the logs, and you could accidentally transport the insect to new areas!



ANSWER KEY

Far From Home: Some other roles of insects include predators (ladybeetles) and providing food to birds and other animals (caterpillars).

Who Was Here?: 1. Pupa and Larva, 2. Larva, 3. Adult, 4. Larva, 5. Larva.

You are most likely to see emerald ash borers in their larval stage.



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Join our team of Plant Heroes and learn about trees, forests, and the natural world around you!

PLANTHEROES.ORG

You can be a Plant Hero!

Are you curious about plants and animals? Do you like asking questions about nature? Do you enjoy being outdoors and having fun, climbing trees, balancing on logs, or finding a new butterfly or beetle? If so, you are already on your way to becoming a Plant Hero! We invite you to join forces with Nate, Laura, Aponi, and Frankie to protect the plants and ecosystems we all love.

How can you become a Plant Hero?

Join our team and go on a journey with Nate, Aponi, Laura, and Frankie. As a Plant Hero, you will learn to notice when plants are in trouble. You will also find out ways you can act quickly to help find solutions in your own neighborhood. Follow their adventures and learn how they help plants and ecosystems stay healthy.

On the Plant Heroes website, you will find materials to help you learn about plants, forest health, and ecosystem balance. The more you know, the more you can help protect plants and ecosystems in your own yard, neighborhood, and community!

Plant Heroes strives to spark curiosity about nature and science in all children. Our program provides hands-on, nature-based learning materials for educators to engage children in topics of plant health, ecosystem balance, and forest health. We also spotlight the amazing work our public gardens do in protecting the plants and ecosystems we all depend on through our website and printed materials. Visit plantheroes.org today to learn more!

Plant Heroes is brought to you by the American Public Gardens Association, founded in 1940. Over the last eight decades, the Association has supported the work of public gardens in North America and beyond. Our mission is to champion and advance public gardens as leaders, advocates, and innovators in the conservation and appreciation of plants. Our vision is "A world where public gardens are indispensable" as they provide botanic, conservation, community, education, and economic resources to their community.

The Association is committed to increasing the knowledge of public garden professionals throughout North America through information sharing, professional development, networking, public awareness, and research, so that they have the tools to effectively serve visitors and members.



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