WE NEED YOUR HELP!

We are glad to provide these materials for free. In order for us to continue receiving funding for new materials, we need to collect information on how they are used.
Thank you for taking the time to answer the following one-minute survey.

There are three ways to complete the survey:

1 Scan this code with your smartphone camera

2 Type the following link into your web browser:
https://plantheroes.org/educator-survey

3 Email your answers to:
plantheroes@publicgardens.org

1) Job title
2) Name of organization you belong to
3) What kind of educator are you?
   - Teacher
   - Summer camp counselor
   - Home schooler
   - Public garden educator
   - Informal educator
   - Other (please describe)
4) What grade level do you teach?
   - Elementary (K–5)
   - Middle School (6–8)
   - High School (9–12)
   - Other (please describe)
5) Specify what subject area you teach:
   - Science
   - Math
   - Language Arts
   - Social Studies
   - Other (please describe)
6) How many students do you teach in a school year?

PLANT HEROES

Field Guide:

Walnut Twig Beetle

This tiny beetle and the fungus it carries can greatly affect black walnut trees, a valuable source of wood and delicious nuts!

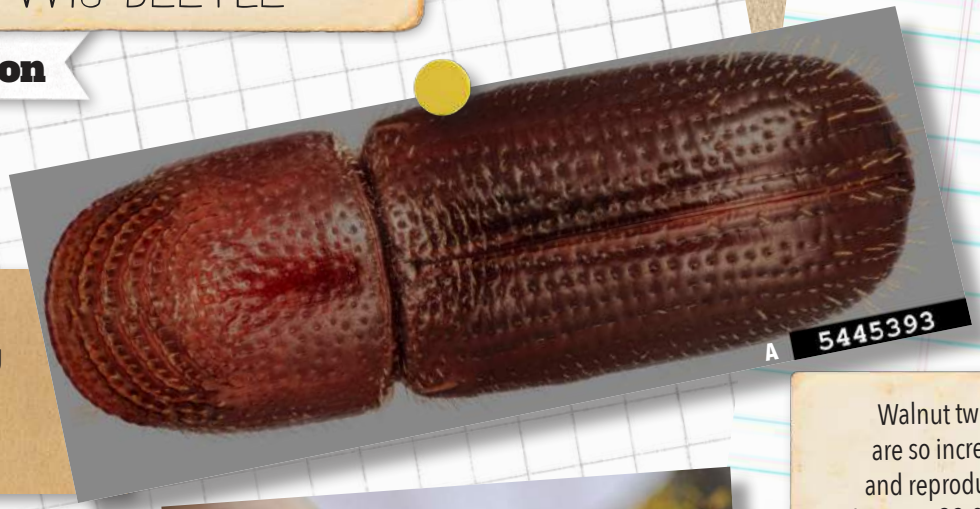
Plant Protection Program

AMERICAN PUBLIC GARDENS ASSOCIATION

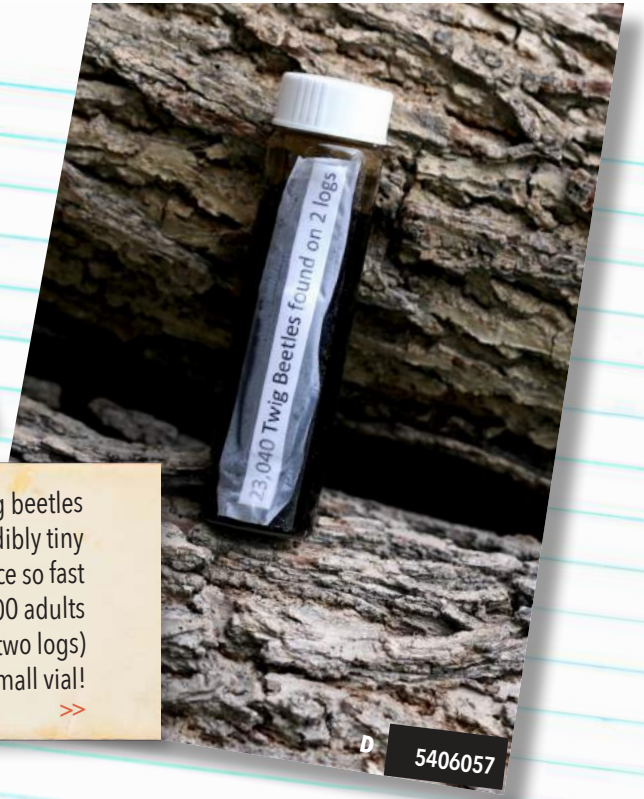
Photo: Invasive.org

WALNUT TWIG BEETLE

Identification



Highly magnified top view of the walnut twig beetle (*Pityophthorus juglandis*). >>



Walnut twig beetles are so incredibly tiny and reproduce so fast that over 23,000 adults (found in just two logs) can fit in this small vial! >>

Walnut twig beetles are TINY! Adults are usually about 0.07 inches (1.7 millimeters) long.

Highly magnified side view of the walnut twig beetle.

PHOTO CREDITS: A: 5445393, E: 5482204 Steven Valley, Oregon Department of Agriculture, Bugwood.org; B: Kathy Keatley Garvey; C: 5445294, D: 5406057 Whitney Cranshaw, Colorado State University, Bugwood.org

PLANT HEROES

WALNUT TWIG BEETLE

Life Cycle

<< Close-up showing both larvae (milky white, grub-like immature stage) and adult (reddish-brown) stages of the walnut twig beetle.

^^ Larvae feed for 4–6 weeks inside the tree in meandering tunnels before they pupate at the end of these tunnels. Adults emerge from the pupae to produce a second generation. Adults are most active from mid-July through late August. In early fall, beetles enter hibernation sites where they will spend the winter.

Close-up showing both walnut twig beetle larva and the white powdery spores of the *Geosmithia* fungus that causes the tree to die. >>

<< Adult beetles spend the winter in cavities excavated in the bark of the trunk. They resume activity by late April and most fly to branches to mate and initiate new tunnels for egg galleries. Through the beetles' tunneling, they transfer the *Geosmithia* fungus to the tree and it begins growing in the tree's wood.

Spores (tiny structures that carry reproductive information to form a new fungus) of *Geosmithia morbida*. >>

<< Collection of *Geosmithia morbida*, the fungus that causes thousand cankers disease. The fungus destroys the vascular tissue of the tree, causing small, black lesions called "cankers" to form at beetle entry points. Thousands of beetles at a time may attack a single tree, which is where the name "thousand cankers disease" comes from.

PHOTO CREDITS: A: 5024090, B: 5382183, C: 5406040 Whitney Cranshaw, Colorado State University, Bugwood.org; D: 5445394 Steven Valley, Oregon Department of Agriculture, Bugwood.org; E: 5406101 Ned Tisserat, Colorado State University, Bugwood.org; F: 5427596 Alan Windham, University of Tennessee, Bugwood.org

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WALNUT TWIG BEETLE

Host Trees

Host trees are trees that the walnut twig beetle lives in and feeds on.

The bark of the black walnut (*Juglans nigra*) is usually light brown with a rough diamond pattern. Black walnut has large leaves (12–24 inches long) that are made up of 10 to 24 leaflets. >>

<< Black walnuts grow to be a medium to large tree up to 100 feet in height and usually have a straight trunk and narrow crown if competing for light in the forest.

<< Branch of black walnut showing the alternate arrangement of its large leaves.

^ Grove of young black walnut trees.

PHOTO CREDITS: A: 5448915 Vern Wilkins, Indiana University, Bugwood.org; B: 0008447 Paul Wray, Iowa State University, Bugwood.org; C: 5454701 Jason Sharman, Vitalitree, Bugwood. org; D: 5399728 Robert Vidki, Doronicum Kft., Bugwood.org

PLANT HEROES

WALNUT TWIG BEETLE

Host Trees 2


A UGA0008149

<< Close-up of flower spikes on a black walnut tree. These appear in late spring, usually near the end of twigs and are 2.5–5.5 inches (6–14 centimeters) long.

The young fruit of the black walnut is light green, round, and 2–2.5 inches (5–6 centimeters) across. >>


B 5474407

To identify the black walnut in winter, look for tan buds that are alternately arranged on the stem. Leaf scars (or the place where leaves attach to the branch) resemble a "monkey face." >>


C 5454059

D 5470912

<< The husk of the walnut fruit turns black as it ripens in late summer to fall. Inside the husk you can find an irregularly grooved, hard nut that contains sweet, oily, and edible meat.


E UGA0008552

<< Cross section of a black walnut twig showing the unique chambers inside the twig.

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WALNUT TWIG BEETLE

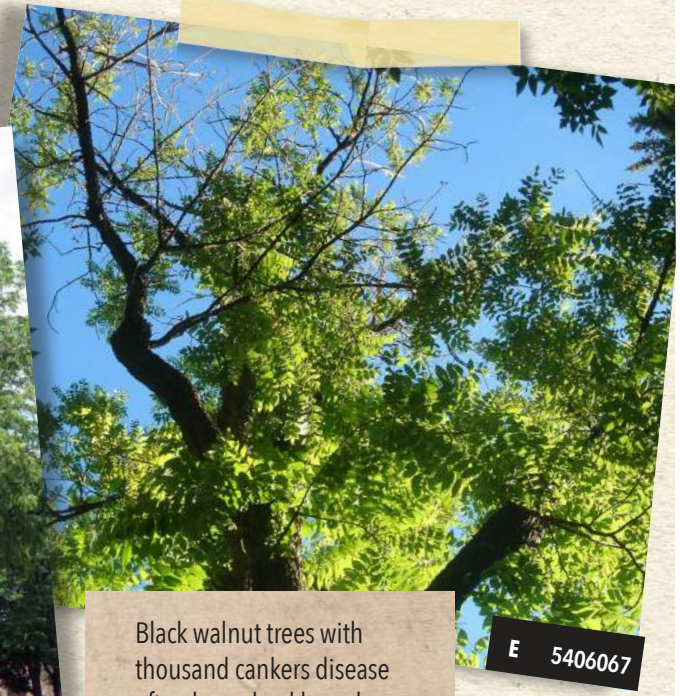
Symptoms

Symptoms are visible clues that a tree may be suffering from a pest or disease issue.

<< Tiny holes created by adult walnut twig beetles as they leave the tree.

<< Close-up of bark showing small piles of sawdust created by beetle tunneling.

<< Yellowing leaves at branch ends can be an early symptom of thousand cankers disease.



Black walnut trees with thousand cankers disease often have dead branches in the upper canopy.

PHOTO CREDITS: A: Karen Snover Clift, Cornell University, Bugwood.org; B: 5382032, C: 5406056, D: 5406044, Whitney Cranshaw, Colorado State University, Bugwood.org; E: 5406067 Curtis Utley, CSUE, Bugwood.org

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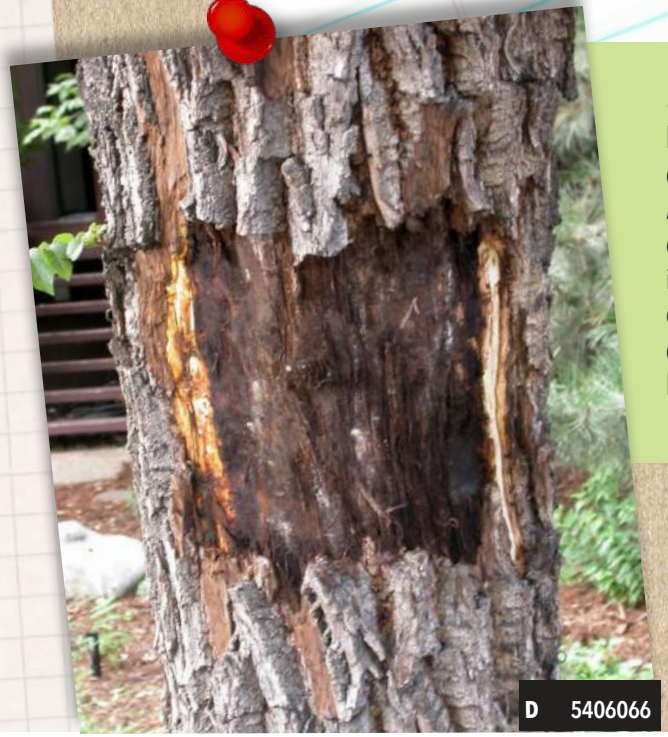
WALNUT TWIG BEETLE

Damage

<< Close-up of a walnut branch showing the early stages of canker development around beetle tunnels.

^ Dark staining caused by *Geosmithia* cankers in black walnut. As these cankers grow together, they stop the flow of water and nutrients in the branch, which results in dead branches on the tree.

Close-up of galleries (or "tunnels") created by a walnut twig beetle under the bark. >>



<< Example of a large trunk canker caused by the fungus *Fusarium solani* that can also occur on trees in advanced stages of decline. A canker is a dead spot on a tree's branches or trunk.

PHOTO CREDITS: A: 5406091, B: 5406087 Ned Tisserat, Colorado State University, Bugwood.org; C: 5024088, D: 5406066 Whitney Cranshaw, Colorado State University, Bugwood.org

PLANT HEROES

PLANT HEROES

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.

American Public Gardens Association

PublicGardens.org

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USDA