

Twolined Chestnut Borer

Agrilus bilineatus



Twolined Chestnut Borer

- First noted in the United States in the 1900's by its infestation of chestnut trees
- Significant pest of damaged or weakened oaks.
- Known tree pest in the eastern and central United States and some southeastern parts of Canada.



The twolined chestnut borer (*Agrilus bilineatus*) is a pest in the eastern and central United States and some southeastern parts of Canada. They were first noted in the 1900's due to their infestation of the American Chestnut. As the chestnut trees slowly declines, the pest found its way into many species of oak as well. These insects are typically secondary pathogens meaning they will only attack a host tree that is previously weakened or damaged. The rise of this pest is due to gypsy moth destruction and defoliation of many chestnut trees in the United States. Today, they are a common pest that always exists at low levels but occasionally, can have outbreaks and cause large scale destruction of trees.

Information sources: 1, 5

Twolined Chestnut Borer Distribution in the U.S.



■ Estimated range of
the twolined
chestnut borer.

Image credits: Haack, R.A., and R.E. Acciavatti, USDA,
<http://www.na.fs.fed.us/spfo/pubs/fids/chestnutborer/chestnutborer.htm>



The twolined chestnut borer has been found throughout eastern and central United States and southeastern Canada. This pest will be of significant concern if oaks in the United States begin to experience a decline due to other pests including exotics.

Information sources: 5

Pest of the American Chestnut and various Oak species



Image credits: American chestnut (*Castanea dentata*) - Vern Wilkins, Indiana University. - [#5480920](http://www.forestryimages.org); white oak (*Quercus alba*) L - Martin MacKenzie, USDA Forest Service. - [#5047040](http://www.forestryimages.org); northern red oak (*Quercus rubra*) L - David Lee - Bugwood.org. #5433070



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Agrilus bilineatus is a pest of mainly the American Chestnut and various types of Oaks. The twolined chestnut borer is a secondary pest of Oak species. It is important to note that it prefers the American chestnut, but due to Dutch Elm's disease it largely no longer exists. As a result, oak is the widely available host for this pest.

American chestnut (*C. dentata*)
White Oak (*Quercus alba*)
Scarlet Oak (*Quercus coccinea*)
Northern pin Oak (*Quercus ellipsoidalis*)
Bur Oak (*Quercus macrocarpa*)
Chestnut Oak (*Quercus prinus*)
Northern red Oak (*Quercus rubra*)
Post Oak (*Quercus stellata*)
Black Oak (*Quercus velutina*)
Live Oak (*Quercus virginiana*)

Information sources: 2

Tree Damage



Premature wilting and browning



Larval galleries



D-shaped holes

Image credits: Figure 2 - <http://www.na.fs.fed.us/spfo/pubs/fids/chestnutborer/chestnutborer.htm>; Figure 3 - <http://www.na.fs.fed.us/spfo/pubs/fids/chestnutborer/chestnutborer.htm>; Figure 5, Minnesota Department of Natural Resources - <http://www.na.fs.fed.us/spfo/pubs/fids/chestnutborer/chestnutborer.htm>



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The first signs of the pest is premature wilting and browning of the tree beginning with the crown and slowly moving down. The twolined chestnut borer larvae will also burrow through the bark and create winding galleries. Other damage includes distinct D-shaped exit holes that are about 3-5mm in size. These signs of damage are common for many wood boring pests so further inspection of damaged hosts is important. Initial damages will not kill the tree. It typically takes several years of infestation to kill the tree and once dead, the tree is no longer a food source to the pests.

Information Sources: 5

Identification

- Adults
 - Greenish black color
 - Look for two yellow stripes on back
 - 5-13mm



Image credits: twolined chestnut borer (*Agnilus bilineatus*) (Weber, 1801) - Pennsylvania Department of Conservation and Natural Resources - Forestry - Bugwood.org, #5016044; twolined chestnut borer (*Agnilus bilineatus*) (Weber, 1801) - Pennsylvania Department of Conservation and Natural Resources - Forestry - Bugwood.org, #5016046



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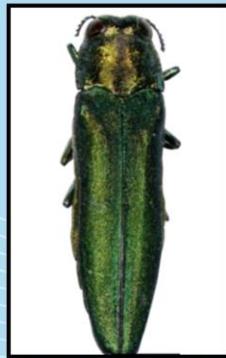
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Adults are a greenish black color with two distinct yellow stripes along the back. They are approximately 5-13mm (1/5-1/2in) long.

Information sources: 4, 5

Lookalikes - Adults



Emerald Ash Borer



Twolined Chestnut Borer

Image credits: twolined chestnut borer (*Agrilus bilineatus*) (Weber, 1801) - USDA Forest Service - Northeastern Area , USDA Forest Service - Bugwood.org, 1396105; emerald ash borer (*Agrilus planipennis*) Fairmaire, 1888 - Pennsylvania Department of Conservation and Natural Resources - Forestry - Bugwood.org, 5016062



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Many sources cite the twolined chestnut borer as a lookalike of the emerald ash borer. Both are found in similar locations throughout the United States. However, the emerald ash borer is a pest of ash trees whereas the twolined chestnut borer is not.

Information sources: 7

Identification

- Larvae

- White, legless, slender bodies
- Two spines on the tip of the abdomen
- 2.5cm



Image credits: twolined chestnut borer (*Agrilus bilineatus*) (Weber, 1801) – James Solomon, USDA Forest Service - Bugwood.org, #3057088; twolined chestnut borer (*Agrilus bilineatus*) (Weber, 1801) – Steven Katovich, USDA Forest Service - Bugwood.org, #5125729; twolined chestnut borer (*Agrilus bilineatus*) (Weber, 1801) – Robert A. Haack, USDA Forest Service - bugwood.org, #3057036

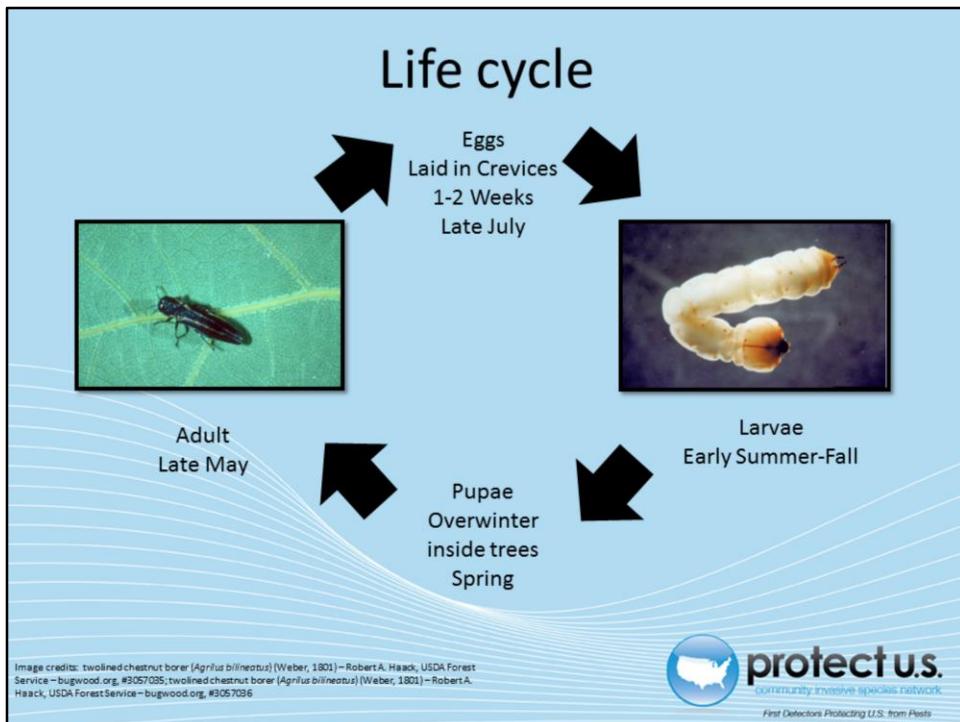


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Agrilus bilineatus larvae are white and legless with slender bodies. The larvae are about 2.5cm (1in) and they have two distinct spines on the tip of the abdomen.

Information sources: 4, 5

Life cycle



The twolined chestnut borer is holometabolous or in other words, undergo complete metamorphosis. Eggs are laid in late July and will hatch in about 1-2 weeks in North America. *Agrilus bilineatus* will overwinter as larvae and pupae in the host trees. Adults will emerge in late May from the bark and form the characteristic D-shaped hole in the bark. They will lay eggs in bark crevices by late July. The eggs will hatch in about 1-2 weeks. There is a single generation of the twolined chestnut borer per year. Larvae are long and slender with a small flattened area behind the head and two spines at the tip of the abdomen. They are white and legless. Larvae will go through 4 instars between early summer and fall. When they are full grown, they will burrow into the outer bark and overwinter in these chambers. The following spring they will turn into pupae and then emerge as adults in late May. Adult beetles are about 5-13mm (1/5-1/2in) length. They have a greenish-black metallic color with two yellow stripes along their backs.

Information sources: 5, 8

Monitoring

- Trees are vulnerable after a year of heavy defoliation or drought
- Look for:
 - Wilting and browning at crown
 - Winding galleries under bark
 - D-shaped exit hole in bark



Image credit: gypsy moth (*Lymantria dispar*) (Linnaeus) - Milan Zubrik, Forest Research Institute - Slovakia - Bugwood.org.
5378081



The twolined chestnut borer is a invasive pest that typically will take advantage of weakened host trees. If the trees experience heavy defoliation from other pests like leaf-eating caterpillars, they are more susceptible to attack. This pest was noted on many trees that were previously weakened by the gypsy moth. Moreover, trees that experience heavy drought are more likely to be attacked by the twolined chestnut borer. An initial sign of infestation is the premature wilting and browning of branches at the crown of the tree. It is also possible to see winding galleries created in the host tissues by feeding larvae. In late spring, exit holes can be seen where adults emerge from the bark. They are characteristically a D-shaped hole about 3-5mm in size.

Information Sources: 1, 5

Chemical Control

- Chemicals: carbaryl, chlorpyrifos, and lindane
- Spray tree trunks
 - 1-2 weeks before adults are expected to emerge
 - 2 week intervals following initial spraying
- Spray infested logs
 - Single application 1-3 weeks before adults are expected to emerge
- Soil drench or injection of imidacloprid



The best approach to chemical control would be to contact your local cooperative extension agency. They will have the most updated information about the chemical treatment of this pest and may have additional recommendations not found in the literature.

U.S. Environmental Protection Agency currently has registered carbaryl, chlorpyrifos, and lindane for the treatment of the twolined chestnut borer. For live trees, the chemicals should be sprayed 1-2 weeks prior to when the adults are expected to emerge and every 2 weeks thereafter. Infested logs should be treated once 1-3 weeks before adults are expect to emerge. These are just recommendations and the labels on all chemicals should be read and followed properly.

Another option is to use a imidacloprid commercially called Merit which is applied as a soil drench or injection into the tree. This will kill larvae as they feed on the tree tissues. This method is recommended for a minimum of three years to treat infection.

In addition, pest management of any leaf-feeding caterpillars may be necessary. Leaf-feeding caterpillars will defoliate trees and make them more susceptible to infestation by the twolined chestnut borer.

Information sources: 5, 6

Natural Control

- The chalcid wasp (*Phasgonophora sulcata*)
- Downy woodpeckers (*Picoides pubescens*)
- Hairy woodpeckers (*Picoides villosus*)



Image credit: chalcid wasp (*Phasgonophora sulcata*) Westwood - David Cappaert, Michigan State University - Bugwood.org, #5371020 ; downy woodpecker (*Picoides pubescens*) (Linnaeus, 1766) - Johnny N. Dell - Bugwood.org, #5482793



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There are a couple natural predators of the twolined chestnut borer. The chalcid wasp (*Phasgonophora sulcata*) kills about 10% of larvae annually. Downy and Hair woodpeckers (*Picoides pubescens* and *Picoides villosus*) will also consume a considerable amount of the pest larvae each year.

Information Sources: 5

Cultural Control

- Felling
- Pruning
- Mark and remove infested oaks
- Tarp infested logs
- Tree traps



Image credit: felling—Mark Adams, Adams Arbor Care, LLC—bugwood.org, #5376245; slashing and bucking - USDA Forest Service - Northeastern Area, USDA Forest Service—bugwood.org, #1395062



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Felling the trees during the summer will dry the host tissues. Since twolined chestnut borers are sensitive to rapid drying of tissues, this can kill larvae. It is best to do this soon after most of the eggs have been laid in late July in North America. Additionally, pruning infested branches can help control beetle populations. The infested branches can be identified by their early browning and wilting. They should be cut below the last wilted leaf on each branch and removed. The infested branches should be disposed of by burning, chipping, or burying before adults emerge. This technique is critical during the first year of infection.

To protect other trees, severely infested or dead chestnut or oak trees can be marked and removed before adults emerge in the spring. Removing the outer bark from the salvaged logs will kill most of the overwintering larvae inside. If the wood cannot be destroyed or debarked before the adults emerge, cover the logs with a large tarp and base it with soil to trap the adults as they emerge. The tarp must remain sealed until June so that the adults will surface from the wood and then die.

Tree traps can also be used to attract adults. The tree should be girdled close to the ground 1-4 weeks before the adults are expected to emerge. The adults will be attracted to lay eggs on the girdle, but the larvae will die due to the drying of the tree tissues.

Information Sources: 5

Suspect Sample Submissions

- Contact your State Department of Agriculture or University Cooperative Extension laboratory

– <http://www.npdn.org/home>

- PPQ form 391, Specimens for Determination

– https://www.aphis.usda.gov/library/forms/pdf/PPQ_Form_391.pdf

SPECIMENS FOR DETERMINATION		SUBMITTER INFORMATION		CNS APPROVED	
NAME OF SUBMITTER		NAME OF COLLECTOR		TEST NUMBER	
ADDRESS OF SUBMITTER		ADDRESS OF PROPERTY OWNER		TEST DATE	
PHONE NUMBER		ZIP		PROMPT	
NAME OF SUBMITTER		NAME AND ADDRESS OF PROPERTY OWNER		PRIORITY	
ADDRESS OF SUBMITTER		CITY STATE COUNTY ZIP		PRIORITY	
PHONE NUMBER		LATITUDE LONGITUDE		PRIORITY	
REASON FOR IDENTIFICATION (If available items)		NAME AND ADDRESS OF PROPERTY OWNER		PRIORITY	
A. Biological Control (Target Pest Name)		B. Economic Pest (Target Pest Name)		C. Pest Survey (Target Pest)	
D. Imported Pest of Regulatory Concern (Species in REMARKS)		E. Spreading Invasive/Trade Compliance (SPIC)		F. Other (Species in REMARKS)	
G. Pest Product Pest		H. Pest in REMARKS			
If prompt or urgent identification is requested, please provide a brief explanation under "REMARKS"					
TYPE OF PEST (Submit name and name of culture if appropriate)		NUMBER OF SPECIMENS		Pest affected (check boxes and indicate)	
I. PLANT DISTRIBUTION		J. PLANT PARTS INFECTED		K. GROWTH STAGE	
L. Limited		M. Leaves, Upper Surface		N. Roots, Tuber, Corms	
O. Regional		P. Stems, Lower Surface		Q. Shoots	
R. National		S. Flowers		T. Seeds	
S. Worldwide		U. Fruits		V. Pests or Nuts	
X. PEST DISTRIBUTION		Y. PLANT PARTS INFECTED		Z. GROWTH STAGE	
A. FEW		B. LEAVES		C. ADULTS	
C. COMMON		D. STEM		E. YOUNG SHOOT	
D. REGIONAL		E. FLOWERS		F. SEEDS	
E. NATIONAL		F. FRUIT		G. MATURE	
F. WORLDWIDE		G. NUTS		H. CYSTS	
X. RECORDS		Y. NUMBER OF SPECIMENS		Z. METHODS	
A. FEW		B. LEAVES		C. MORPHOLOGY	
C. COMMON		D. STEM		D. PHYSIOLOGY	
D. REGIONAL		E. FLOWERS		E. CULTURE	
E. NATIONAL		F. FRUIT		F. SEROLOGICAL	
F. WORLDWIDE		G. NUTS		G. ISOLATION	
X. SAMPLING METHODS		Y. TYPE OF TRAP AND LINE		Z. TEST NUMBER	
A. FIELD		B. LAB		C. TEST NUMBER	
X. IDENTIFICATION		Y. DETERMINED BY		Z. POSITION AND AFFILIATION	
X. FINAL DETERMINATION AND NOTES (Not for Field use)		Y. DATE		Z. METHODS	
X. FIRST NAME (Please Print First Name)		Y. DISTRIBUTION OF SPECIMEN(SAMPLE)		Z. METHODS	
A. Natural		B. Number for		C. MORPHOLOGY	
C. Domestic		D. Estimated		D. PHYSIOLOGY	
D. Imported		E. Transferred to		E. CULTURE	
E. Quarantine		F. LAB CONFIRMATION NUMBER		F. SEROLOGICAL	
F. Research		G. DATE		G. ISOLATION	
X. SIGNATURE		Y. DATE		Z. DATE RECEIVED	
X. PRINT DATE: 08/01/2014		Y. PRINT DATE: 08/01/2014		Z. PRINT DATE: 08/01/2014	

An example of a PPQ form for sample submissions

Image credits: https://www.aphis.usda.gov/library/forms/pdf/PPQ_Form_391.pdf



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If a suspect pest has been located in the United States, a sample should be submitted for proper identification. Contact your local diagnostic lab to ship in a sample for identification. Information regarding your local diagnostic lab is available at National Plant Diagnostic Network (NPDN) website. The diagnostic lab information and available contacts are divided by state.

<http://www.npdn.org/home>

The sample specimen should be submitted along with accompanying documentation using the PPQ form 391.

https://www.aphis.usda.gov/library/forms/pdf/PPQ_Form_391.pdf

Your local diagnostic lab is part of your local cooperative extension service or your state department of agriculture. Your local lab will also have a specific form. All local labs may not be a member of NPDN. However, all labs should report new pest and pathogen detections to local regulatory officials.

Communications

- Contact your State Plant Health Director
 - https://www.aphis.usda.gov/aphis/ourfocus/planhealth/ppq-program-overview/ct_sphd
- Contact your State Plant Regulatory Official
 - <http://nationalplantboard.org/membership/>



Image credits: <http://www.usda.gov/wps/portal/usda/usdahome>; <http://nationalplantboard.org/>



Remember that new pest and pathogen records must be reported to your State Plant Health Director (SPHD) and your State Plant Regulatory Official (SPRO). The SPRO is a State Department of Agriculture Employee and the SPHD is a USDA-APHIS-PPQ employee.

The link to your SPRO is on the National Plant Board (NPB) website. It has an interactive map and when you click on your state it will take you to another page with contact information. The NPB is a cooperative organization that includes membership from all State Departments of Agriculture.

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Our Partners

- United States Department of Agriculture, National Institute of Food and Agriculture (USDA NIFA)
- United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine (USDA APHIS PPQ)
- Cooperative Agriculture Pest Survey (CAPS) Program
- National Plant Board (NPB)
- States Department of Agriculture
- Extension Disaster Education Network (EDEN)
- Center for Invasive Species and Ecosystem Health (Bugwood)
- National Plant Diagnostic Network (NPDN)
- U.S. Department of Homeland Security (DHS)
- U.S. Forest Service (USFS)



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