Observatree
monitoring tree health

Field Identification Guide

Bronze birch borer

Photograph: Karl W. Hillig

Forest Research
Llywodraeth Cynulliad Cymru Welsh Assembly Government
Scottish Forestry Coilltearachd na h-Alba
fera
Forestry Commission
National Trust
WOODLAND TRUST
Animal & Plant Health Agency
Department for Environment Food & Rural Affairs

Bronze birch borer

The bronze birch borer (BBB, *Agrilus anxius*), a beetle belonging to the family Buprestidae, is a serious North American insect pest of birch trees (*Betula* species). The BBB causes extensive mortality to birch populations and can attack trees with stems greater than 2 cm in diameter and branches of 1 cm in diameter. Damage is caused by larvae feeding on the inner bark and cambium of the tree. Repeated attacks and the excavation of numerous winding galleries by the larvae cause disruption to water and nutrient transportation within the tree, leading to death of tissues above and below ground. In many cases tree mortality is observed within just a few years of the appearance of the first symptoms.

Species affected	All species of birch are susceptible to this pest. In its natural range of North America, BBB is considered to be a secondary pest of the native birch. In contrast, Asian and European species such as our native silver and downy birch (*Betula pendula* and *B. pubescens*) are much more susceptible to this pest.
Signs and symptoms	BBB infestation is usually difficult to detect until the symptoms become severe because much of the insect's life cycle is hidden within the tree; eggs are laid in crevices, the larvae feed in the inner bark and pupation occurs in the sapwood. In most cases, the beetles have already become established and have spread to new hosts by the time they are discovered. The adults are small (7–12mm long), elongate, metallic bronze-coloured beetles. They live for approximately 23 days and are strong fliers. They feed up in the canopy of the tree and are well camouflaged. Foliage feeding damage is thought to be minimal and therefore not a reliable indicator of the pest. Early signs of BBB infestation include discoloration/yellowing of the foliage and a thinning of the crown or individual branches. This occurs as the larval galleries become extensive on the trunk or in branches and start to disrupt water and nutrient transport within the tree. Crown dieback and dying branches typically occur from the top of the tree down as the infestation progresses. The presence of dead, retained leaves and epicormic growth (prolific sprouting) on the main stem and larger branches and in the crown is common in infested trees. Galleries are created by BBB larvae as they feed beneath the

	bark of infested trees. Typical BBB galleries are sinuous and filled with frass (sawdust-like waste material). The galleries become progressively larger as the larvae creating them increase in size. Callus (healing tissue) formation following the pattern of feeding galleries can be observed in thin-barked birch species as bark swellings and welts. Rust-coloured sap which stains the outer bark may be visible oozing from the affected stems and branches. Fully grown larvae are approximately 25–38 mm long, pale cream with a flattened body and two small pincer-like spines/projections at their rear end. The head is mostly hidden within the body segments with just the mandibles visible. As the adults/beetles emerge from the tree, D-shaped exit holes are left in the bark (about 3–5 mm wide). These are characteristic of BBB infestation. However, these exit holes are rarely found in the early stages of infestation and are more often seen in trees that are almost dead and have lost around two-thirds of their crowns. Other native insects can cause similar symptoms on birch to those caused by BBB. For example, longhorn beetles and bark beetles may leave exit holes in the bark, but these holes tend to be round or oval, rather than D-shaped, and occur much more commonly in dead trees/wood. Canopy thinning, crown and branch dieback and discoloration of foliage can be caused by a number of factors other than BBB, such as drought, waterlogging, poor silvicultural management and adverse environmental conditions. Infection by fungal root pathogens such as *Phytophthora cambivora*, *P. cinnamomi* and honey fungus (*Armillaria* spp.) can also lead to similar symptoms in the crown. Sunken cankers and fissures on stems and branches, and tip dieback on young shoots, can be caused by fungal pathogens such as *Anisogramma virgultorum* and *Marssonina betulae*. However, the presence of D-shaped exit holes and larval galleries under the bark are two key indicators of BBB which can differentiate it from other factors.

Timing	Canopy thinning, crown and branch dieback and discoloration of foliage can be seen during the summer months when the trees are in leaf. The adult beetles emerge between May and July but are unlikely to be seen due to their cryptic lifestyle. Bark symptoms will be visible all year round, especially as birch trees are fairly open-stemmed. The time that the BBB takes to complete its life cycle depends on geographical location, local temperatures and condition of the host. It is anticipated that in the UK the life cycle will take two years because of our relatively cool summers.
Biosecurity	Birch wood with a diameter of just 1 cm and over can contain BBB life-stages; therefore, it is extremely important that no wood or foliage from birch trees is removed from a potentially infected site. Vehicles should also be checked for live beetles. If any birch material is intentionally removed from a site (e.g. for sampling), then it should first be triple-wrapped in strong and robust plastic bags, or double-wrapped in bags which then must be secured within a plastic container. Beetles for identification should be securely contained within a robust plastic container and sent to the Tree Health Diagnostic and Advisory Service (THDAS), Forest Research, Alice Holt Lodge, Farnham, Surrey, GU10 4LH.
Reporting requirements	If you find this pest, please report it through Tree Alert (https://treealert.forestresearch.gov.uk). In Northern Ireland please report via the TreeCheck website (www.treecheck.net) or phone app, or by emailing planthealth@daera-ni.gov.uk For traded plants and any non-tree hosts please email planthealth.info@apha.gov.uk (England & Wales), or hort.marketing@gov.scot (Scotland).

Based on information available in November 2017.

Signs and symptoms

Photograph: Dave Williams, Forest Research

Thinning crowns of silver birch trees caused by a bronze birch borer infestation.

Signs and symptoms

Photograph: Steven Katovich, USDA Forest Service, Bugwood.org

Discoloration of foliage and dieback in the crown caused by a bronze birch borer infestation. Note that some of the affected leaves have been retained.

Signs and symptoms

Photograph: USDA Forest Service - Northeastern Area , USDA Forest Service, Bugwood.org

Dieback in the crown caused by a bronze birch borer infestation.

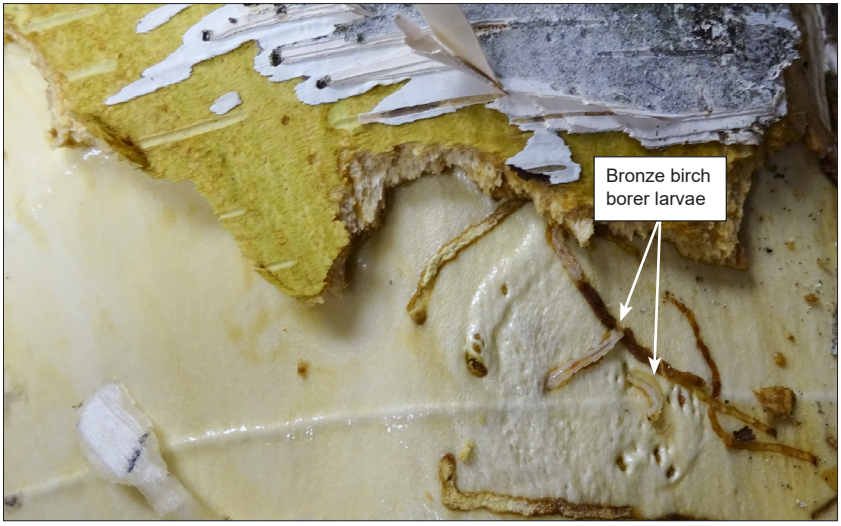
Photograph: Dave Williams, Forest Research

Epicormic growth on paper birch (*Betula papyrifera*) caused by a bronze birch borer infestation.

Signs and symptoms

Photograph: Steven Katovich, USDA Forest Service, Bugwood.org

Callus (healing tissue) forming welts over larval feeding galleries of bronze birch borer.



Photograph: Dave Williams, Forest Research

Bronze birch borer larvae (size range 2–38 mm long) beneath the bark of silver birch.

Photograph: Dave Williams, Forest Research

Bronze birch borer larvae (size range 2–38 mm long) beneath the bark of silver birch.

Photograph: David G. Nielsen, The Ohio State University, Bugwood.org

Bronze birch borer larva excavating a gallery in living bark tissues.

Photograph: Dave Williams, Forest Research

Bronze birch borer galleries beneath the bark of paper birch.

Photograph: Dave Williams, Forest Research

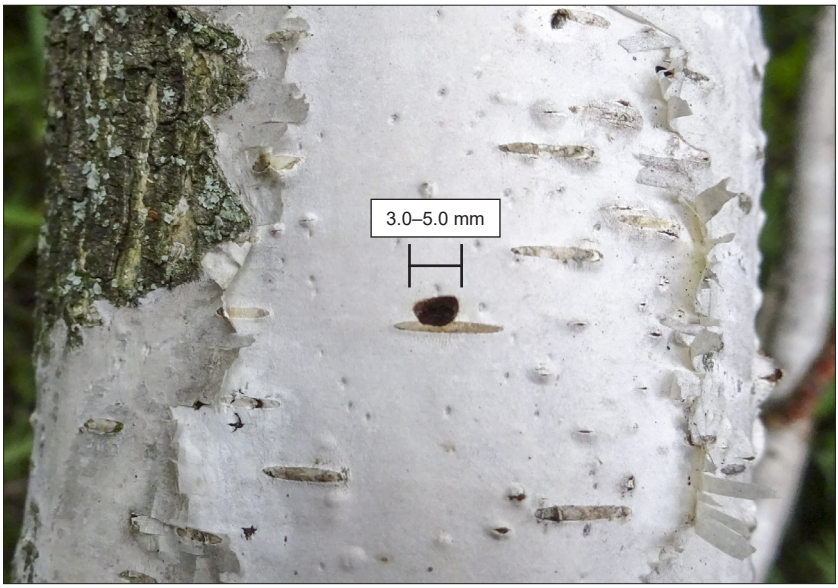
Bronze birch borer galleries beneath the bark of silver birch.

Photograph: David G. Nielsen, The Ohio State University, Bugwood.org

Larval feeding galleries of the bronze birch borer.

Photograph: Whitney Cranshaw, Colorado State University, Bugwood.org

Adult bronze birch borer beetle.



Photograph: Dave Williams, Forest Research

D-shaped exit holes of the bronze birch borer beetle in silver birch.

Photograph: Dave Williams, Forest Research

D-shaped exit holes of the bronze birch borer beetle in silver birch.

Photograph: Sarah Green, Forest Research

Crown dieback in birch caused by pathogenic fungi such as *Anisogramma virgultorum* and *Marssonina betulae*.

Photograph: Ferenc Lakatos, University of Sopron, Bugwood.org

Ventilation holes in the bark of a birch tree produced by the birch bark beetle *Scolytus ratzeburgi*.

Photograph: Beat Forster, Swiss Federal Institute for Forest, Snow and Landscape Research, Bugwood.org

Galleries and ventilation holes produced by the birch bark beetle.

Photograph: Pest and Diseases Image Library, Bugwood.org

Adult birch bark beetle.

Published by Forest Research as part of the Observatree project.

Observatree aims to create a tree-health early-warning system using citizen science.

Observatree is a partnership project led by Forest Research, the research agency of the Forestry Commission. Project partners are the Animal & Plant Health Agency (APHA), Department for Environment, Food & Rural Affairs (Defra), Fera Science Ltd, the Forestry Commission, the National Trust, Scottish Forestry, the Welsh Government and the Woodland Trust. Supporting the project is Natural Resources Wales. The first four years of this project was 50% funded by the EU's LIFE programme.

Acknowledgements:

Dr Suzanne Sancisi-Frey, Forest Research, for compiling this guide based on a review of current literature and with technical contributions from experts across the Observatree partnership.

All those who have given permission for images to be used within the guide.

The Communications Team, Forest Research, for the original design and creation of the guide.

This booklet forms part of a set that supports Observatree volunteers when out looking for priority pests and diseases. It supplements face-to-face training and is not intended as a full or detailed description. It will also be useful for others who have some knowledge of the particular pest or disease and understand how to look for these. Further information is available online from the websites listed below:

www.observatree.org.uk

www.forestresearch.gov.uk/tools_and_resources/fthr/pest-and-disease-resources/

www.gov.uk/guidance/prevent-the-introduction-and-spread-of-tree-pests-and-diseases

https://planthealthportal.defra.gov.uk

FR(GB-SSF)/FG560/FEB18-17/0043