

BACTERIAL TREE DISEASE FACT SHEETS



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DISEASES OF WOODLAND TREES CAUSED BY *BRENNERIA* SPECIES



Bacteria belonging to the genus *Brenneria* are responsible for causing diseases on woody hosts. Species cause a range of cankers, wilts and necroses on willow, oak, alder and walnut and are also associated with disease-causing species of *Lonsdalea*.

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<https://bacterialplantdiseases.uk/bac-stop>



WATERMARK DISEASE OF WILLOW



Diseased cricket-bat willow trees - Christian Malford, Wiltshire, England.

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Watermark disease of cricket-bat willow, viewed as cross section to show internal symptoms - Duxford, Cambridge, England.

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Status: Non-quarantine

Causal organism: *Brenneria salicis*

Host species

Many *Salix* spp. are affected, but the pathogen can also reside in non-symptomatic poplar and alder.

Distribution

The disease is widespread in the Netherlands and is also found in Belgium, Italy, Hungary (frequently on *Salix alba* in Europe) and Japan (from *Salix bakko*, *Salix sachalinensis*, and *Salix kinuyanagi*) (EPPO, 2020).

Occurrence in the UK

B. salicis is found mostly in East Anglia, but there have been isolated outbreaks in Leicestershire and Wiltshire.

Symptoms of the disease

Leaves on some branches suddenly wilt and turn reddish-brown during spring and summer months. These branches die and become leafless. Sapwood of affected branches and trunks show water-soaked brown lesions or a red-brown stain. Staining is usually restricted to the outermost annual rings, but sometimes covers the entire transverse section of branch/trunk. After cutting, bacteria can ooze (and spread) from watermark-stained lesions. Seriously diseased trees often die. Although shoots may recover and grow leaves, these are often re-infected with the pathogen and subsequently die.

Control measures

Preventative: In the UK, growers should be made aware of the disease and associated risks. As the bacteria can be present in young trees that do not exhibit symptoms of the disease, nursery stock should be screened for the presence of *B. salicis* prior to planting out. Control of soil nitrogen levels due to excess fertilisation may also help reduce disease incidence.

Curative: In ornamental plantings in the Netherlands, highly susceptible clones have been replaced with more resistant cricket-bat willow trees.



SHALLOW BARK CANCKER OF WALNUT



Shallow cankers with dark weeping on trunk of 'Hartley' walnut.

Courtesy B. Teviotdale



'Hartley' walnut with outer layers of bark removed to reveal extent of affected tissues.

Courtesy B. Teviotdale

Status: Potential
quarantine pathogen

Causal organism: *Brenneria nigrifluens*

Host species

Several *Juglans* species including English walnut, also known as Persian walnut (*Juglans regia*), and black walnut (*Juglans nigra*) are susceptible to the disease. *B. nigrifluens* has also been shown to cause cankers on the common fig (*Ficus carica*) in Iran.

Distribution

The disease is widespread and is found in Europe (France, Hungary, Italy, Serbia and Spain), Asia (Iran, Republic of Korea and Taiwan), North America (California and Texas, USA) and South America (Argentina).

Occurrence in the UK

B. nigrifluens has not been detected in the UK.

Symptoms of the disease

The disease is visible on the trunks or main branches as dark brown patches, sometimes with weeping. Lesions are usually restricted to the outer bark layers and unlike deep bark canker, rarely spread to the phloem tissue.

Control measures

Preventative: There are no control measures for shallow bark canker as there is no data to support that the disease causes yield losses. Some growers remove diseased tissue to try and prevent the spread of the disease.

Curative: None known.



DEEP BARK CANCKER OF WALNUT



Fluid flowing from longitudinal cracks in trunk.
Courtesy B. Teviotdale



Symptoms of systemic infection, with reddish brown fluid weeping from cracks in trunk and limbs.
Courtesy B. Teviotdale

Status: Non-quarantine

Causal organism: *Brenneria rubrifaciens*

Host species

English, or Persian, walnut (*Juglans regia*) and black walnut (*Juglans hindsii* and *Juglans nigra*) are susceptible to deep bark canker.

Distribution

Deep bark canker of walnut has been recorded in the USA, Spain and Iran.

Occurrence in the UK

B. rubrifaciens has not been detected in the UK.

Symptoms of the disease

The disease is characterised by deep vertical cankers developing on the stem of the tree. It differs from shallow bark canker in that the cankers develop deep into the phloem tissue, often resulting in cracks running along the length of the stem. Underlying the cankers are lesions that often ooze reddish-brown to dark-brown fluid. The disease initially starts on the stem of the tree, but with time moves to branches, eventually affecting the productivity of the tree. Rootstocks are not usually affected by the disease.

Control measures

Preventative: Good water management, fertilisation, pruning and pest management help prevent predisposition of trees to deep bark canker. These management practices are also recommended to reduce canker formation.

Curative: None known. Chemical applications and antibiotic injections are not effective in reducing cankers. Similarly, removing cankered areas is ineffective and often harmful to the trees.



BARK CANCKER OF ALDER



Alnus cordata with bleeding symptoms of *B. alni* infection - Garfagnana, Italy.
Courtesy F. Moriondo



Section of *Alnus glutinosa* stem with dark spots in the sapwood.
Courtesy F. Moriondo

Status: Potential quarantine pathogen

Causal organism: *Brenneria alni*

Host species

Black alder (*Alnus glutinosa*), Italian alder (*Alnus cordata*) and Caucasian alder (*Alnus subcordata*) are affected by the disease.

Distribution

The disease was first reported in Italy in 1996 and there were no subsequent records until recently when it was reported as the causal agent of bark canker on Caucasian alder in Iran.

Occurrence in the UK

B. alni has not been detected in the UK.

Symptoms of the disease

Infected trees have longitudinally elongated small, dark brown cankers in the bark of stems, branches and twigs, which appear water-soaked. The lesions spread laterally as the infection progresses to reach the cambium and sometimes the first layers of wood. A dark watery liquid often oozes from small cracks in the cankers and stains the bark surface.

Control measures

No control measures are known.



ACUTE OAK DECLINE



Symptoms of AOD, including weeping stem bleeds, on *Quercus robur*

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Fluid between cracked bark plates caused by decaying underlying tissue.

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Status: Non-quarantine

Causal organism: *Brenneria goodwinii* is part of a pathobiome that includes *Gibbsiella quercinecans*, *Rahnella victoriana* and *Lonsdalea britannica*. These bacteria work together to cause Acute Oak Decline (AOD).

Host species

In the UK, mature (older than 50 years) pedunculate (*Quercus robur*) and sessile oak (*Q. petraea*) are affected. However, Bali oak (*Q. fabri*), holm oak (*Q. ilex*), oriental white oak (*Q. aliena* var. *acutiserrata*), pin oak (*Q. palustris*), Pyrenean oak (*Q. pyrenaica*), red oak (*Q. rubra*), scarlet oak (*Q. coccinea*), Turkey oak (*Q. cerris*), water oak (*Q. nigra*), chestnut-leaved oak (*Q. castaneifolia*), Persian oak (*Q. brantii*) and downy oak (*Q. pubescens*) are also susceptible. In Iran, *B. goodwinii* has also been isolated from hornbeam (*Carpinus betulus*).

Distribution

Brenneria goodwinii has been isolated from bleeding stem cankers on oak trees in the United Kingdom, Austria, France, Latvia, Netherlands, Poland, Spain, Switzerland and Iran.

Occurrence in the UK

AOD is present in warm, drought-prone parts of the UK where there are also high levels of airborne nitrogen pollution and low dry sulphur levels. It is found mostly in south-eastern, central and eastern England, and in the Welsh Borders and South-East Wales. As of 2020, it has not been reported in Scotland or Northern Ireland.



ACUTE OAK DECLINE



Longitudinal stem bleeds on *Quercus robur*.
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D-shaped exit holes caused by two-spotted oak buprestid beetles (*Agilus biguttatus*)
©Crown copyright. Forest Research

Status: Non-quarantine

Symptoms of the disease

Affected trees have dark-coloured, vertical, weeping fissures, known as stem bleeds or cankers, which seep black fluid through vertical cracks between bark plates and down the trunks. A lesion (decayed tissue) forms in the live tissue beneath the bleeds. This seeping fluid can dry and cake on the tree stems at certain times of the year. D-shaped exit holes of emergent two-spotted oak buprestid beetles (*Agilus biguttatus*) are often found on bark panels close to bleeds. Larval galleries belonging to these beetles are frequently associated with the lesions.

Control measures

A number of different plant pathogens can cause bleeding cankers on oak stems. It is therefore important to ascertain the cause of a bleeding canker by recording the location of the tree, taking photos of stem bleeds and associated D-shaped buprestid beetle holes, and sending this information together with swabs of the bleeds to Forest Research. Forest Research have developed a rapid test to detect the bacteria involved in AOD.

Preventative: If laboratory tests together with photographic evidence confirm that an oak tree has AOD, general advice is to leave infected trees in place and continue to monitor, unless there is immediate concern about safety. Try to minimise any contact with bleeds to reduce the possibility of transferring the disease from tree to tree. However, if only a limited number of trees appear to be infected on a site, and most are of the same oak species, it may be prudent to fell and destroy the infected individuals – to keep infection levels low and reduce the risk of infecting healthy trees. When felling trees, equipment should be thoroughly disinfected to prevent spread of bacteria to other trees. Logs and branches should not be removed until the bark and sapwood has been stripped away.

Curative: None known.



SANITATION GUIDELINES



General bacterial sanitisation guidelines

When pruning diseased trees, always remember the following:

- sanitise pruning shears between each tree pruning
- avoid pruning in wet conditions as water will facilitate the spread of bacteria
- if felling trees, clean and sanitise equipment before coming off site
- remember to spray footwear with disinfectant to prevent spread of bacteria from site to site.

Always sanitise with appropriate approved recommended products.

If you are concerned you may have come across any of these pathogens and want to report the disease, please contact Forest Research via TreeAlert:

<https://treealert.forestresearch.gov.uk/>

For further information, please contact DEFRA:

<https://planthealthportal.defra.gov.uk/pests-and-diseases/reporting-a-pest-disease>

INFORMATION SOURCES



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Patrick KN. 1991. Watermark disease of cricket bat willow: guidelines for growers. Research Information Note 197 – Forestry Commission Research Division.

UC IPM Pest Management Guidelines: Walnut UC ANR Publication 3471.
(www2.ipm.ucanr.edu/agriculture/walnut)

www.cabi.org/isc/datasheet/21936 (*Brenneria salicis*)

gd.eppo.int/taxon/ERWISA (*Brenneria salicis*)

Forest Research Pest and Disease Resources
(www.forestresearch.gov.uk/tools-and-resources/fthr/pest-and-disease-resources/)

Bacterial Plant Diseases Programme
(bacterialplantdiseases.uk)