College of Agriculture, Food and Environment
Cooperative Extension Service

Plant Pathology Fact Sheet **PPFS-OR-W-12**

Bacterial Leaf Scorch of Shade Trees

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Importance

Bacterial leaf scorch is a chronic, eventually fatal disease that has devastated many shade trees in Kentucky landscapes and street plantings since the 1980s. Since then, an increasingly large number of urban plantings and historic trees have been destroyed as this disease continues to spread.

Hosts

The bacterial leaf scorch pathogen can infect over 100 plant species, and this list continues to grow as additional hosts and alternative hosts are identified. The most common shade tree hosts in the Commonwealth are various species of oak, maple, and sycamore. Other hosts identified in Kentucky include ash, boxelder, catalpa, dogwood, elm, gingko, hackberry, lilac, mulberry, sweetgum, and yellowwood (Table 1). In addition to these hosts, various small fruit (blackberry, blueberry, grape), herbaceous ornamentals, and weeds are known to be susceptible. Some common alternative hosts include bermudagrass, English ivy, goldenrod, Virginia creeper, and wild strawberry.

Symptoms

Infected trees may leaf-out normally in spring, but by late summer or autumn, affected leaves develop a marginal (Figure 1) or interveinal scorch (Figure 2). Depending on host, foliar scorch symptoms may appear brown, reddish-brown, or olive green (Figures 3A & B). In some hosts, a yellow or reddish-brown band may be present along the interior edge of the scorched tissue (Figures 4A, B, C, D). Affected leaves may drop prematurely or remain attached to branches. Epicormic shoots (water sprouts) can develop at the tree base or along the trunk of severely diseased trees.

Figure 1. Red oak with scorch along the leaf margin.
Figure 2. Sycamore leaves with marginal scorch extending to interveinal leaf regions.

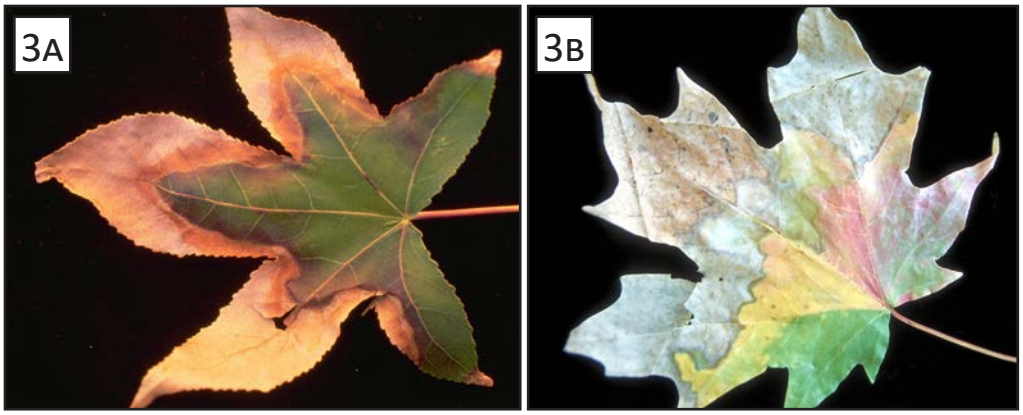
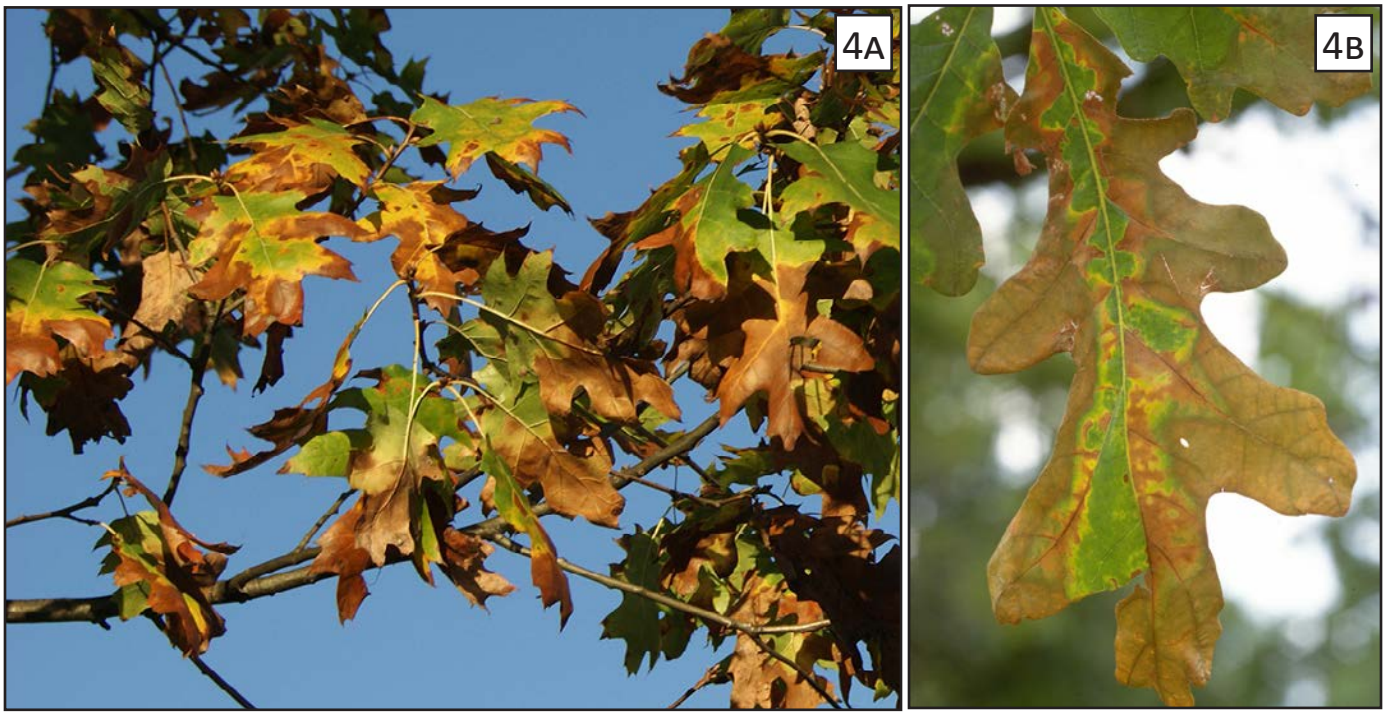


Figure 3. Foliar symptoms of bacterial scorch can vary greatly depending on the host. Sweetgum leaves (**A**) have a marginal scorch with reddish-brown banding on the inner edge of the necrotic region while sugar maple (**B**) shows wide gray banding with a dark margin.



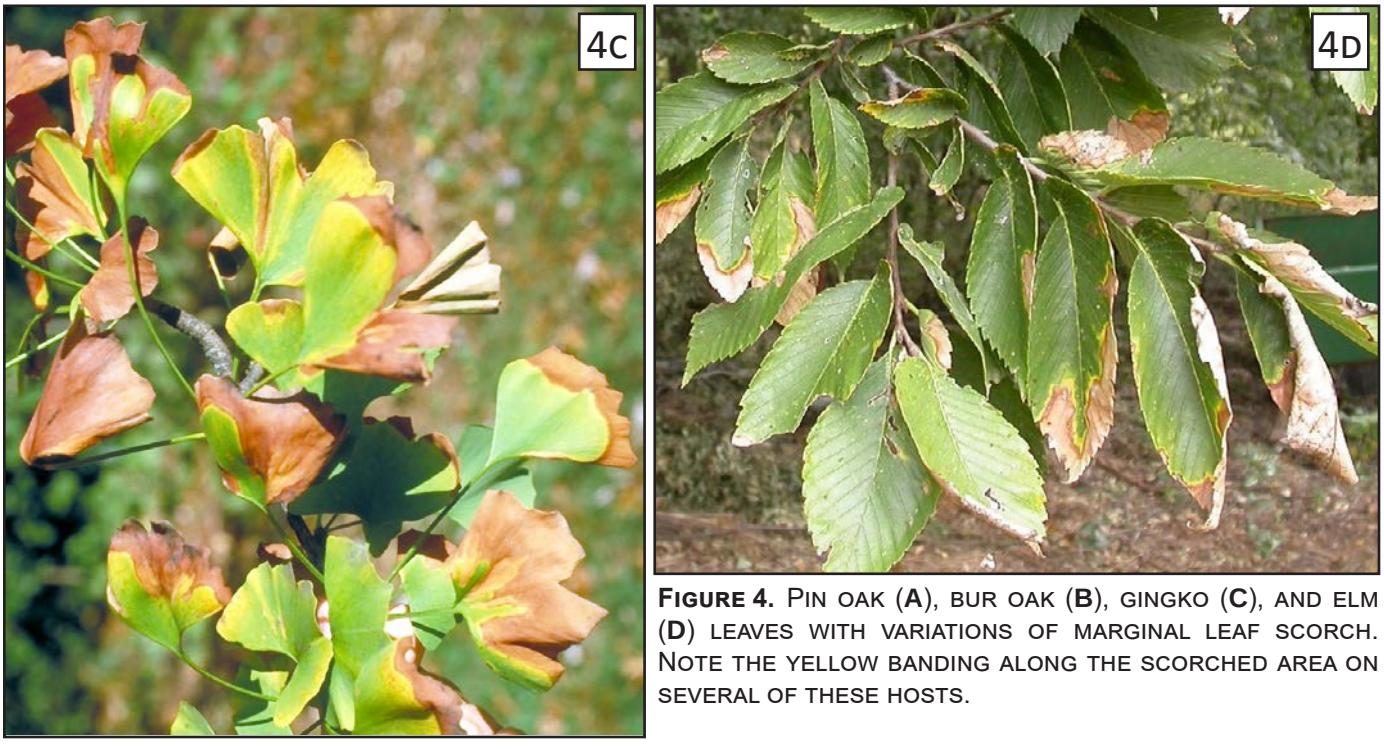


Figure 4. Pin oak (**A**), bur oak (**B**), gingko (**C**), and elm (**D**) leaves with variations of marginal leaf scorch. Note the yellow banding along the scorched area on several of these hosts.

Figure 5. Pin oak with advanced dieback symtoms.

Affected branches with scorch symptoms may initially be randomly distributed throughout the tree, or flagging may develop on one or a few branches. As more and more branches are affected, the disease takes its toll and causes twigs and branches to die back (Figure 5) until eventually the entire tree dies. Tree decline can seem to occur relatively quickly, especially under additional environmental stresses, such as drought. However, the disease typically progresses slowly over several years.

Foliar symptoms alone are not definitive for this disease since leaf scorch can also occur when trees are affected by abiotic factors (e.g. drought, transplant shock), as well as other diseases (e.g. vascular wilts, root decay). A positive diagnosis can only be determined with a laboratory analysis.

Testing for Bacterial Leaf Scorch

When bacterial leaf scorch is suspected, leaf tissue and petioles can be tested for the presence of the bacterium in a laboratory assay. Samples should be submitted to the UK Plant Disease Diagnostic Lab by going through a local Cooperative Extension Service office.

The best time to collect samples is late summer or early autumn when the number of bacterial cells in the tissue is highest. Collect and submit at least 20 symptomatic leaves (with intact petioles) that show clear marginal scorch symptoms. In addition, it is advisable to submit branches so they can be examined for other vascular wilt diseases, cankers, injuries, etc., in case the test for bacterial leaf scorch is negative or there are additional problems present. Samples should be submitted to an Extension office the same day they are collected.

Table 1. Partial listing of woody plant hosts susceptible to *Xylella fastidiosa*.

Common Name	Scientific Name
Blackberry	*Rubus* sp.
Blueberry	*Vaccinium* sp.
Boxelder	*Acer negundo*
Buckeye	*Aesculus* sp.
Catalpa	*Catalpa speciosa*
Dogwood, flowering	*Cornus florida*
Dogwood, oriental	*Cornus kousa*
Elm, American	*Ulmus americana*
Elm, Dutch	*Ulmus x hollandica*
Elm, Siberian	*Ulmus pumila*
Elm, wych	*Ulmus glabra*
Gingko	*Gingko biloba*
Grape, cultivated & wild	*Vitis sp.*
Hackberry	*Celtis occidentalis*
Maple, red	*Acer rubrum*
Maple, silver	*Acer saccharinum*
Maple, sugar	*Acer saccharum*
Lilac	*Syringa vulgaris*
Linden	*Tilia sp.*
London plane	*Platanus* x *acerifolia*
Mulberry	*Morus alba*
Oak, black	*Quercus velutina*
Oak, bluejack	*Quercus incana*
Oak, bur	*Quercus macrocarpa*
Oak, chestnut	*Quercus prinus*
Oak, English	*Quercus robur*
Oak, laurel	*Quercus laurifolia*
Oak, live	*Quercus virginiana*
Oak, northern red	*Quercus rubra*
Oak, pin	*Quercus palustris*
Oak, post	*Quercus stellat*
Oak, scarlet	*Quercus coccinea*
Oak, shingle	*Quercus imbricaria*
Oak, Shumard	*Quercus shumardii*
Oak, southern red	*Quercus falcate*
Oak, swamp chestnut	*Quercus michauxii*
Oak, swamp white	*Quercus bicolor*
Oak, turkey	*Quercus laevis*
Oak, water	*Quercus nigra*
Oak, white	*Quercus alba*
Oak, willow	*Quercus phellos* .
Sweetgum	*Liquidambar styraciflua*
Sycamore	*Platanus occidentalis*
Yellowwood	*Cladrastis kentukea*

Cause & Disease Development

Bacterial leaf scorch is caused by the bacterium, *Xylella fastidiosa*. There are several strains or subspecies of this organism, which vary in host specificity and ability to cause disease.

Xylella fastidiosa is spread by certain sap-sucking insects in the Cicadellinae and Cercopidae families, such as leafhoppers, treehoppers, and spittlebugs. These insects have piercing-sucking mouthparts that enable them to extract nutrients from a tree's xylem (water conducting tissue). During feeding, the insect vector either acquires the bacterium to transmit to other susceptible hosts or deposits the bacterium it has already acquired. Because the bacterium can multiply within its esophagus, the insect can continue to transmit the pathogen until it molts or dies.

Once *X. fastidiosa* enters a tree, it may remain undetected for several years before symptoms are apparent. Bacteria in active infections multiply in the xylem and spread upward toward branch tips. Scorch is a typical symptom of water stress and, in this case, results from the build-up of bacterial cells and host defense compounds clogging xylem vessels and slowing water uptake to leaves. Timing of symptom development in mid- to late summer in urban trees is often associated with moisture and heat stresses occurring during the growing season, placing additional stress on the host.

While spread from tree-to-tree does not appear to occur very rapidly, *X. fastidiosa* may also be present in many other hosts, such as shrubs, grasses, and weeds growing in landscapes. Thus, the insect vectors may not necessarily pass the disease from tree-to-tree, but may initially acquire the bacterium from these alternative hosts.

Disease Management

There is no cure for bacterial leaf scorch, and trees will continue to decline over a period of several years. However, following cultural practices that promote tree vigor may help slow the rate of decline.

Cultural Practices to Promote Tree Vigor

Prune

Remove and destroy branches as they become infected and exhibit symptoms. It is unknown if this practice will slow disease progress, but it can help improve the tree's aesthetic value and results in the removal of hazardous limbs.

Irrigate

Apply supplemental water during hot, dry weather to relieve water stress, which can contribute to decline.

Apply mulch

Adding a layer of mulch to the entire root zone can help preserve soil moisture and reduce water stress.

Fertilize

Apply fertilizer and adjust soil pH according to soil test results to help promote tree health. Avoid over-fertilization.

Other Options

Tree replacement

Begin planting one or more non-susceptible replacement trees in the vicinity so that they will attain a reasonable size before the diseased tree must be removed. Choose native trees or those with a history of doing well in Kentucky landscapes. See Additional Resources (at the end of this publication) for more information on potential replacement trees.

Tree removal

As trees decline and become a safety hazard, complete tree removal will be necessary.

Tree injections

While there are commercial antibiotic tree-injection products available for managing bacterial leaf scorch, these treatments lack positive long-term research results. In addition, the repeated injections necessary to slow disease progress provide ports of entry for decay organisms, which infect trees and cause additional damage. Use of tree injections is not recommended because they are not long-lasting, are expensive, and inherently damage trees.

Insecticides

Attempts to manage the insect vectors using insecticides have proven ineffective in preventing the spread of the bacterial leaf scorch pathogen.

Additional Resources

Bacterial Leaf Scorch

- Bacterial Leaf Scorch of Shade Trees (American Phytopathological Society)
https://www.apsnet.org/edcenter/apsnetfeatures/Pages/BacterialLeafScorch.aspx
- Insect Vectors and Current Management Strategies for Diseases Caused by Xylella fastidosa in the Southern United States (Journal of Integrated Pest Management)
https://academic.oup.com/jipm/article/8/1/12/3745634

Tree Replacement

- Native Trees of Kentucky
https://www.uky.edu/hort/Native-Trees-of-Kentucky
- Trees with Minimal Insect and Disease Problems for Kentucky Landscapes (HO-94)
http://www2.ca.uky.edu/agcomm/pubs/ho/ho94/ho94.pdf

Other Problems that Cause Leaf Scorch

- Leaf Scorch and Winter Drying of Woody Plants (PPFS-OR-W-17)
https://plantpathology.ca.uky.edu/files/ppfs-or-w-17.pdf
- Stress and Decline in Woody Plants (ID-50)
http://www2.ca.uky.edu/agcomm/pubs/id/id50/id50.pdf
- Transplant Shock: Disease or Cultural Problem? (PPFS-OR-W-19)
https://plantpathology.ca.uky.edu/files/ppfs-or-w-19.pdf
- How Dry Seasons Affect Landscape Plants (ID-89)
http://www2.ca.uky.edu/agc/pubs/id/id89/id89.pdf
- Verticillium Wilt of Woody Plants PPFS-OR-W-18
https://plantpathology.ca.uky.edu/files/ppfs-or-w-18.pdf

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