Virginia Cooperative Extension
Virginia Tech • Virginia State University
www.ext.vt.edu

Bacterial Leaf Scorch of Landscape Trees

Authored by Elizabeth A. Bush, Extension Plant Pathologist and Lina Rodriguez Salamanca, Instructor, Diagnostician, and Manager, Plant Disease Clinic, School of Plant and Environmental Sciences, Virginia Tech

Introduction

Bacterial leaf scorch is an important and often lethal disease of many landscape trees, particularly in the southern and eastern U.S. In Virginia landscapes it is most often observed on oak, elm, and sycamore; however, many other landscape tree species are susceptible to this disease. The bacterium that causes bacterial leaf scorch colonizes the tree's water-conducting tissue (xylem) , disrupting water movement and reducing water availability to the tree. The symptoms of bacterial leaf scorch are very similar to symptoms of other problems that limit water uptake. This is why marginal leaf scorch symptoms caused by other problems, such as drought stress or root disease, are often mistaken for symptoms of bacterial leaf scorch. Laboratory identification of the causal bacterium *(Xylella fastidiosa*) from affected petiole and leaf tissue is necessary for positive confirmation of the disease.

Figure 1A. Characteristic marginal scorch symptoms of bacterial leaf scorch with a band of yellow between brown and green tissue on elm leaves. (Photo by E.A. Bush, Virginia Tech)

Symptoms

Symptoms of bacterial leaf scorch usually appear in the latter part of summer and progress through the fall. The most characteristic symptom of this disease is marginal leaf scorch. A yellow band is often evident between brown and green tissue (figures 1 A and B).

Figure 1B. Characteristic marginal scorch symptoms of bacterial leaf scorch with a band of yellow between brown and green tissue on ginko leaves. (Photo by E.A. Bush, Virginia Tech).

This yellow band is characteristic of bacterial leaf scorch. In contrast, no yellow band is typically observed between brown and green tissue when marginal leaf scorch is caused by other problems (e.g., drought, root disease, salt injury). However, this symptom is not always present on bacterial leaf scorch-diseased leaves (figure 2).

Other symptoms, depending on the host species, include leaf yellowing, browning and premature leaf drop. On many oak species, brown leaves do not drop prematurely; however, on pin oak (*Quercus palustris*) marginal scorch symptoms may not occur, but leaves may drop prematurely. On trees with an indeterminate growth habit, such as elm and sycamore, symptoms on infected branches begin on older leaves and move to younger leaves; on trees with a determinate habit, such as oak, all leaves on a diseased branch are the same age and show symptoms at the same time.

Initial symptoms of bacterial leaf scorch often appear on only one or two branches before gradually spreading to more and more branches in subsequent years (figure 3).

Figure 2. This oak was confirmed positive for bacterial leaf scorch, yet the leaf symptoms do not include a band of yellow between brown and green tissue (Photo by E.A. Bush, Virginia Tech).

Figure 3. A cluster of bacterial leaf scorch-affected branches are apparent low on this Camperdown elm (*Ulmus glabra* 'Camperdownii') while the rest of the tree appears unaffected by the disease (Photo by E.A. Bush, Virginia Tech).

Diseased trees may also leaf out later than normal in the spring and leaves may be stunted. Although this disease is a vascular disease, the vascular tissue does not discolor. The severity of bacterial leaf scorch on an individual tree can vary considerably from year to year and drought can contribute to greater disease severity. Over time, however, trees gradually decline and lose vigor as defoliation and dieback continue to occur, and eventually, the disease may be lethal.

Disease Cycle

The pathogen that causes bacterial leaf scorch is spread by insect vectors. The primary vectors are leafhoppers called sharpshooters (figure 4), but other insects, such as spittlebugs, also vector the bacterium.

Figure 4. This adult glassy-winged sharpshooter (*Homalodisca vitripennis*) is a type of leafhopper and a known vector of *Xylella fastidiosa*. (Image courtesy of Reyes Garcia III, USDA Agricultural Research Service, Bugwood.org.)

These insect vectors have piercing and sucking mouthparts that allow them to penetrate the tree's water-conducting tissue (xylem) and extract nutrients. An insect acquires the bacterium by feeding on infected plant tissue; subsequently, the insect may spread the bacterium to noninfected hosts while feeding. Once a plant is infected with the bacterium, the disease becomes systemic since the bacteria move throughout the tree in the tree's water transport system.

Susceptible Tree Species

Many oaks are susceptible to bacterial leaf scorch and oaks in the red oak group are most commonly afflicted with this disease. Elms and sycamore are also relatively common hosts of the disease in Virginia. The disease is also reported on many other tree species, such as maple, hackberry, mulberry, sweet gum, and gingko. (Refer to table 1 for a list of selected susceptible tree species.)

Table 1. Some trees on which bacterial leaf scorch have been reported. (Note: This list is not exhaustive regarding either species or genera and new hosts of bacterial leaf scorch continue to be identified.)

Scientific name	Common name
Acer negundo	boxelder
Acer rubrum	red maple
Acer saccharinum	silver maple
Acer saccharum	sugar maple
Cornus floridaa	flowering dogwood
Cornus kousa[a]	dogwood
Platanus occidentalis	American sycamore
Platanus x acerifolia	London planetree
Quercus alba	white oak
Quercus bicolor	swamp oak
Quercus coccinia	scarlet oak
Quercus falcata	southern red oak
Quercus imbricaria	shingle oak
Quercus incana	bluejack oak
Quercus laevis	turkey oak
Quercus laurifolia	laurel oak
Quercus macrocarpa	bur oak
Quercus nigra	water oak
Quercus palustris	pin oak
Quercus phellos	willow oak
Quercus prinus	chestnut oak
Quercus rubra	northern red oak
Quercus shumardii	shumard oak
Quercus stellata	post oak
Quercus velutina	black oak
Quercus virginiana	live oak
Ulmus americana	American elm
Ulmus glabra	wych elm
Ulmus pumila	Siberian elm
Ulmis x hollandica	Dutch elm
Celtis occidentalis	hackberry
Gingko biloba gingko	ginko
Liquidambar styraciflua	sweetgum
Morus rubra	Red mulberry

Source: Sinclair, W.A., and H.H. Lyon. 2005.
[a]* To date, Cornus species have not been diagnosed with bacterial leaf scorch in the Virginia Tech Plant Disease Clinic.

Some other woody plants that are reported hosts of *X. fastidiosa* include oleander (*Nerium oleander*), peppervine (*Ampelopsis arborea*), beauty berry (*Callicarpa americana)*, Virginia creeper (*Parthenocissus quinquefolia*), American elder (*Sambucus canadensis*), southern highbush blueberry (interspecific *Vaccinium corymbosum* hybrids), and grape (*Vitis species*). *X. fastidiosa* is also an economically significant pathogen of several important fruit and nut trees (e.g. almond, citrus, plum, peach, pecan) and many weeds and grasses are hosts to *X. fastidiosa*. Many plant species have also been identified as asymptomatic hosts of X. fastidiosa. The host list of this pathogen continues to grow.

Diagnosis of the disease

Late summer or early fall are the best times to test for bacterial scorch, since this is when *X. fastidiosa* is most active and bacterial populations in the tree's water conducting tissue are highest. Testing too early in the growing season has sometimes been demonstrated to result in a false negative result. The Virginia Tech Plant Disease Clinic can diagnose this disease and other plant diseases. Refer to the Plant Disease Clinic website (https://bit.ly/VTplantclinic) for the current diagnostic form, fees, and instructions on collecting an appropriate diagnostic sample and submitting a sample to the Plant Disease Clinic.

Management

There are currently no curative controls for bacterial leaf scorch. Injection of antibiotics into diseased trees has been shown to slow the spread of the disease, but will not cure the tree. Antibiotic injection is an expensive option and trees must be treated on an ongoing basis. Injection holes are also prone to colonization by wood decay fungi that can negatively impact the health of the tree. Control of leafhoppers and other vectors of *X. fastidiosa* is not effective in preventing spread of bacterial leaf scorch to non-infected trees. Avoiding stress to trees and maintaining them in optimal health can help trees better withstand the effects of bacterial leaf scorch, resulting in a longer period of time in which they are aesthetically acceptable and survive. Since bacterial leaf scorch progresses gradually over a period of years, this is a reasonable approach to controlling the disease. Providing water to trees during hot, dry periods of the summer and during drought are the most critical tactics to help trees avoid stress. This is particularly important if a tree has been already been diagnosed with bacterial leaf scorch. Mulching trees can also help avoid water stress; however, mulch trees with a shallow layer of mulch (~2" deep) and place it in a donut shape around the trunk so that no mulch comes in contact with the trunk. Deep mulch and mulch in contact with the trunk are detrimental to tree health. Ensuring adequate nutrient uptake by having soil tested by the Virginia Tech Soil Testing Lab (http://www.soiltest.vt.edu/) is also recommended. Soil samples should be submitted through your local Virginia Cooperative Extension office https://ext.vt.edu/offices.html). Soil test results will give details on correcting the soil pH if pH is found to be a problem. Inspecting diseased trees on an annual basis to determine the extent of dieback is also recommended, so that pruning and/or removal options may be considered. Pruning out dead wood is recommended: remove branches back to healthy tissue (white or cream-colored in cross-section).

Replacing diseased trees is another option for homeowners and urban landscapers. Trees with extensive dieback are best removed. Choose replacement trees that are not reported hosts of bacterial leaf scorch or other major pests and that are well-adapted to the location. (New hosts of bacterial leaf scorch continue to be identified, so it is prudent to avoid all species of tree genera on which the disease has been reported.) Some trees to consider as replacements include: European black alder *(Alnus glutinosa*), European beech (*Fagus sylvatica*), black gum (*Nyssa sylvatica*), yellow buckeye (*Aesculus flava*), northern catalpa (*Catalpa speciosa),* katsuratree (*Cercidophyllum japonicum*), Kentucky coffeetree (*Gymnocladus dioicus*)**, American linden (*Tilia americana*), littleleaf linden (*T. cordata)*, silver linden (*T. tomentosa*), cucumbertree (*Magnolia acuminata*), Osage orange (*Maclura pomifera*)**, tulip poplar (*Liriodendron tulipifera*), and Japanese zelkova (*Zelkova serrata*). Refer to the Virginia Cooperative Extension fact sheet: Problem-free Trees for Virginia Landscapes (publication #450-237) (https://pubs.ext.vt.edu/450/450-237/).

**Purchasing fruitless male cultivars of these species may be desirable since the fruits may be a nuisance.

References

Bush, E.A. Bacterial Leaf Scorch---Common Plant Diseases in the Landscape and Garden. VCE Master Gardener You Tube. https://youtu.be/XHqd2cahtME?si=Yenm7aCC50t-zhZ5

Gould, A. B. and J. H. Lashomb. 2005. APS Feature Story: Bacterial Leaf Scorch of Shade Trees.

Hopkins, D. L. 1989. *Xylella fastidiosa*: Xylem-limited bacterial pathogen of plants. Annual Review of Phytopathology 27:271-290.

Sherald, J. L. 2007. Bacterial leaf scorch of landscape trees: what we know and what we do not know. Arboriculture and Urban Forestry 33(6): 376-385.

Sinclair, W.A., and H.H. Lyon. 2005. Diseases of Trees and Shrubs, 2nd ed. Ithaca, N.Y.: Cornell University Press.Acknowledgements

This publication benefited from the advice of Dr.Alex Niemiera and Mary Ann Hansen, School of Plant and Environmental Sciences, Virginia Tech.

2024 3001-1433 (SPES-568NP)