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UK COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY — COLLEGE OF AGRICULTURE

Plant Pathology Fact Sheet

Bacterial Leaf Scorch

by John Hartman

Introduction

Bacterial leaf scorch has devastated many landscape and shade trees in Kentucky's urban forests in recent years. Especially hard hit have been the mature pin oaks lining many urban streets. First diagnosed in the U.S. in the early 1980s, this epidemic shows no signs of abating.

Symptoms

Bacterial leaf scorch is a chronic, eventually fatal disease that is most noticeable in the early fall. Symptoms include premature leaf browning, marginal necrosis (FIGURE 1) and defoliation. Infected trees leaf-out normally the following year; however leaves on a few more branches turn prematurely brown in late summer. These events repeat themselves over a period of several years until the entire tree turns prematurely brown (FIGURE 2). Trees gradually decline over the years as twigs, branches, and limbs die from continual defoliation (FIGURE 3). Because symptoms of this disease can sometimes be confused with other abiotic, stress-related problems, it is advisable to have the diagnosis confirmed with a special laboratory test.

FIGURE 1. KENTUCKY OAKS WITH BACTERIAL LEAF SCORCH CAN INCLUDE (L TO R FROM TOP) RED, SHINGLE, BUR, WHITE AND PIN OAK.

FIGURE 2. BACTERIAL LEAF SCORCH CAUSES PREMATURE BROWNING OF PIN OAK (L) COMPARED TO UNAFFECTED TREE (R).

Leaf tissue can be tested for the presence of the bacterium at the University of Kentucky Plant Disease Diagnostic Laboratory.

Cause and Spread

Bacterial leaf scorch is caused by the bacterium *Xylella fastidiosa*. This bacterium is spread by leafhoppers and treehopper insects, although it does not appear to be spread from tree to tree very rapidly. Nevertheless, in some neighborhoods where the disease has been present for many years, a high proportion of mature oaks may show symptoms of bacterial leaf scorch (FIGURE 4). Little is known about which of these leafhopper vectors are active in Kentucky. There is some evidence that *X. fastidiosa* is present in symptomless shrubs, grasses and weeds in the landscape. Thus, leafhoppers may not necessarily pass the disease from tree to tree, but may be acquiring the bacterium from other hosts.

FIGURE 3. PIN OAK WITH BRANCH DIEBACK RESULTING FROM CHRONIC BACTERIAL LEAF SCORCH DISEASE.

The pathogen infects the xylem where it partially blocks the flow of water to the leaves, resulting in leaf scorch symptoms. Some researchers working with this disease suggest that leaf scorch symptoms are more severe during times when other stresses are placed on the tree. Timing of symptom development in mid- to late summer in urban trees is often associated with various moisture and heat stresses occurring that season.

Host Range and Location

Bacterial leaf scorch is found throughout much of the eastern and southern U.S. In Kentucky, it is present in landscape trees in many urban areas, including Paducah, Madisonville, Owensboro, Bowling Green, Somerset, Louisville, and Lexington. This disease has not been detected in Kentucky's forest trees.

FIGURE 4. STREET TREE PIN OAKS BEGIN TO SHOW DECLINE DUE TO BACTERIAL LEAF SCORCH (L), WITH COMPLETE LOSSES OCCURING A FEW YEARS LATER (R).

Bacterial leaf scorch has been commonly observed in oaks, especially pin oak and red oak, and in sycamore in Kentucky. It is also occasionally found here in red maple, sugar maple, silver maple, London plane, hackberry, mulberry, elm, and sweetgum. Refer to TABLE 1 for a list of known hosts, and FIGURES 1, 5 and 6 for typical symptoms.

Disease Management

There is no cure for bacterial leaf scorch, so one should expect diseased trees to

Figure 5. Symptoms of Bacterial Leaf Scorch on Silver Maple (above) and Sugar Maple (L). Red Maples and Boxelders are also susceptible.

be gradually lost over the years. Because infected trees decline gradually, it may be 5 to 10 years before there are many dead limbs and branches present. In the meantime, tree owners can provide good growing conditions for the trees to prolong their survival and to enhance their aesthetic value.

• Pruning. Newly infected trees can be made to look somewhat presentable for a few more years if the dead wood is pruned out.

• Watering trees. Kentucky summer weather can sometimes be hot and accentuated by periods of drought lasting anywhere from a week to several months. A study conducted by the University of Maryland demonstrated a possible correlation between bacterial leaf scorch and water stress. Based on their results, Kentucky tree owners and landscape managers may be able to prolong the lives of their scorch-infected trees by applying supplemental water during the hot, dry parts of the growing season.

• Tree–injections. There are commercial tree-injection products containing the antibiotic oxytetracyclene which are sold and used for the management of bacterial leaf scorch disease. Injections, which are made into the root flare at the base of the tree, may provide temporary remission of the symptoms. To be effective, however, the antibiotic would need to be re-injected, perhaps annually or more often. In Kentucky, we have observed symptoms in pin oaks and red oaks treated with antibiotic injections can be delayed by several weeks. These treatments do not cure infected trees, but they may prolong the life of the tree. Researchers with the National Park Service who are combating this disease in elms on the Mall in Washington, D.C. have not found injections to be an effective long-term solution.

Research has also shown that injections by themselves can cause long-term problems for trees since the injection holes may become ports of entry for wood rotting organisms. Even when decay organisms do not invade, areas of the wood behind the injection point are rendered discolored and non-functional. If frequent re-treatment is required, injections are likely to cause considerable damage over the life of a tree.

In summary, while treatments may prolong tree life, long term research results are not available and injections inherently damage trees. Thus, the choice to use of antibiotic injections for bacterial leaf scorch would vary with the wishes and objectives of the tree owner.

• Tree replacement. The best remedy for bacterial leaf scorch is tree replacement. Begin planting non-susceptible replacement trees early so that they will attain a reasonable size before the diseased ones are removed. When replanting, it is not necessary to use large transplants. Often, smaller nursery stock becomes established more quickly than larger nursery stock so that after 10 years, their relative sizes might not be much different. During the several years following tree planting, make provisions for watering the trees regularly, applying mulch periodically,

and pruning trees correctly so that good, strong, branch structure is established when the trees are young.

To maintain species diversity and to prevent catastrophic tree losses due to diseases or insects, avoid planting all the same tree species in a neighborhood, or a community. Select trees that do well in Kentucky, such as those included in the University of Kentucky materials listed in Additional Resources.

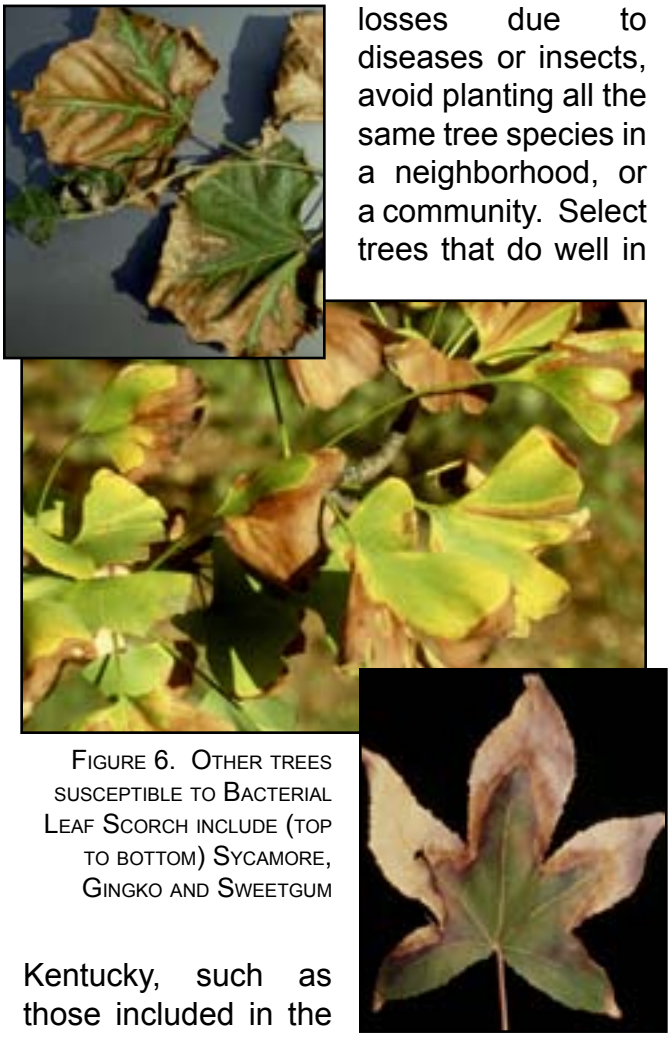

Figure 6. Other trees susceptible to Bacterial Leaf Scorch include (top to bottom) Sycamore, Gingko and Sweetgum

Refer to Table 2 for a list of large-sized trees that have not yet been affected by bacterial leaf scorch. These trees might make suitable replacements for trees lost along streets, in parks and in yards. Some may have other drawbacks. Readers are urged to learn more about the habits of these trees before purchasing plants. If a selection will be used as a street tree, it should first be determined if that species is permitted by the local municipal arborist or tree authorities.

Additional Resources

The following University of Kentucky resources can be helpful in selecting appropriate replacement trees.

Available at County Extension Offices (publications)

- *Large Trees, the Giants of Kentucky's Landscape* by Fountain, W. M., Witt, M. L., and Swintosky, J. S. (1996). 45 p.

- *Medium-Sized Trees for Kentucky Landscapes* by Witt, M. L., Fountain, W. M., and Swintosky, J. S. (1995). 42 p.

- *Small Trees for Urban Spaces in Kentucky* by Witt, M. L., Nash, L. J., Fountain, W. M., and Crankshaw, N. (1995). 40 p.

Available for use at County Extension Offices (compact disks)

- *Large Trees for Kentucky Landscapes* by Robert Geneve and Christy Cassady

- *Small and Medium Trees for Kentucky Landscapes* by Robert Geneve and Christy Cassady

Available on the Web

- Native Trees of Kentucky (Department of Horticulture)
http://www.uky.edu/Ag/Horticulture/kytreewebsite/treeprofiles/treelist.htm

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Table 1. Tree species known to be susceptible to bacterial leaf scorch.

Family or group	Common name	Scientific name
Dogwood	Flowering dogwood	*Cornus florida*
	Oriental dogwood**	*C. kousa*
Elm	American elm*	*Ulmus americana*
Gingko (Figure 6)	Maidenhair tree**	*Gingko biloba*
Hackberry	Common hackberry*	*Celtis occidentalis*
Maple (Figure 5)	Box elder*	*Acer negundo*
	Red maple*	*A. rubrum*
	Silver maple*	*A. saccharinum*
	Sugar maple*	*A. saccharum*
Mulberry	White mulberry*	*Morus alba*
Oak (Figure 1)	Black oak	*Quercus velutina*
	Bluejack oak	*Q. incana*
	Bur oak*	*Q. prinus*
	Chestnut oak	*Q. macrocarpa*
	English oak**	*Q. robur*
	Laurel oak	*Q. laurifolia*
	Live oak	*Q. virginiana*
	Northern red oak*	*Q. rubra*
	Pin oak*	*Q. palustris*
	Post oak	*Q. stellat*
	Scarlet oak*	*Q. coccinea*
	Shingle oak*	*Q. imbricaria*
	Shumard oak	*Q. shumardii*
	Southern red oak	*Q. falcate*
	Swamp chestnut oak**	*Q. michauxii*
	Swamp white oak	*Q. bicolor*
	Turkey oak	*Q. laevis*
	Water oak	*Q. nigra*
	White oak*	*Q. alba*
	Willow oak*	*Q. phellos*
Sweetgum (Figure 6)	American sweetgum*	*Liquidambar styraciflua*
Sycamore (Figure 6)	American sycamore*	*Platanus occidentalis*
	London plane*	*P. x acerifolia*

* Bacterial leaf scorch is present in Kentucky on these trees.
** Bacterial leaf scorch is present in Kentucky, but not in other states, on these trees.

Table 2. Tree species that have not yet been affected by bacterial leaf scorch

Family or group	Common name	Scientific name
Alder	European black alder	*Alnus glutinosa*, and cultivars
Ash	Blue Ash	*Fraxinus quadrangulata*
	White ash	*F. americana* and cultivars
	Green ash	*F. pennsylvanica* and cultivars [1]
Black gum	Tupelo	*Nyssa sylvatica*
Buckeye	Yellow buckeye	*Aesculus flava*
Beech	European beech	*Fagus sylvatica* and cultivars
Catalpa	Northern catalpa	*Catalpa speciosa*
Coffeetree	Kentucky Coffeetree	*Gymnocladus dioicus* and fruitless male cultivars
Cork tree	Amur cork tree	*Phellodendron amurense* and fruitless male cultivars
Elm	Lacebark or Chinese elm	*Ulmus parvifolia* [2]
Hackberry	Sugar hackberry	*Celtis laevigata* [3]
Hickory	Shagbark hickory	*Carya ovata*
	Shellbark hickory	*C. laciniosa*
	Pignut hickory	*C. glabra*
Katsura	Katsuratree	*Cercidophyllum japonicum*
Linden	American linden	*Tilia americana*
	Littleleaf linden	*T. cordata*
Magnolia	Cucumbertree	*Magnolia acuminata*
Maple	Black maple	*Acer saccharum* subsp. *nigrum* [4]
Oak	Chinkapin oak	*Quercus muehlenbergii* [5]
	Sawtooth oak	*Q. acutissima*
Osage-Orange	Hedge-apple	*Maclura pomifera* and fruitless male cultivars
Sassafras	Common sassafras	*Sassafras albidum*
Tulip poplar	Tuliptree	*Liriodendron tulipifera*
Zelkova	Japanese zelkova	*Zelkova serrata* and cultivars

[1] Ash might not be a good choice due to the impending invasion of the emerald ash borer.

[2] Although bacterial leaf scorch is a serious problem of American elm, its effect on Chinese elm is not known.

[3] Sugar hackberry may be a risky choice since the disease is present on common hackberry.

[4] Although the disease has not been detected on black maple, the fact that it occurs on four other maples in Kentucky makes this a risky choice.

[5] These oak species have not been observed with bacterial leaf scorch. However, the fact that it occurs on most other oaks makes them risky choices.