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Bacterial Leaf Scorch Disease of Oak and Other Trees and Ornamentals

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As Oklahoma's weather pattern begins to transition into the dry and hot portions of the summer, the devastating symptoms of bacterial leaf scorch (BLS) will begin to manifest on our trees and ornamentals. Bacterial leaf scorch (BLS) of ornamental and horticultural crops and Pierce's disease (PD) of grape are caused by a bacterium, *Xylella fastidiosa*. Pierce's disease has been a significant problem in California wine grape production since the 1880's. Since then, PD has spread to other grape-growing regions of the United States where winters are mild and freezing is limited. These areas include Florida, Texas, and most states along the Gulf Coast. Recently, BLS has been observed on shade trees as far north as New Jersey. Bacterial leaf scorch is becoming an increasingly important disease of shade trees and ornamentals in much of the United States including Oklahoma. Diseased trees in urban environments become unsightly and hazardous as they die and decay. Removal and disposal costs of diseased trees can exceed several thousands of dollars depending on tree size and location. Bacterial leaf scorch is also a concern for golf courses, which rely on ornamental trees for shade, wind protection, and as obstacles to enhance the challenge of play.

In Oklahoma, PD of grape has not been identified. However, BLS was first reported on elm (*Ulmus americanus*) in Oklahoma in 2004. *Xylella fastidiosa* was identified from weeds and trees in 8 of 12 Oklahoma counties in a subsequent survey conducted in 2005. To date, BLS has been confirmed in Oklahoma to affect oak, elm, sycamore, and mulberry (Fig. 1). *Xylella fastidiosa* can be transmitted by grafts, which also creates concern about the incidence of the disease in Oklahoma pecan production. Differences in genetic composition have been identified among strains of *X. fastidiosa*. These differences are responsible for host specificity by strains of the bacterium, where only certain strains will infect and cause disease on certain hosts. Recent studies suggest that this is complicated, as some strains can cause disease on additional hosts during laboratory cross-inoculation experiments. While the predominant *X. fastidiosa* strain in Oklahoma infects shade trees, other strains have been discovered in the state. The extent of their host range and impact on agriculture and horticulture is unknown.

Fig. 1. A, Foliar discoloration and thinning of an oak tree as a result of bacterial leaf scorch disease B, Leaf symptom of scorch disease of elm C, Leaf symptom of scorch disease of mulberry.

Xylella fastidiosa is mainly transmitted by insect vectors from the sharpshooter subfamily of leafhoppers (Cicadellidae: Cicadellinae) and spittlebug family (Cercopidae). As many as 39 different species of these insects have the capability to transmit *X. fastidiosa*. In California and Texas, the most important insect vector is *Homalodisca coagulata* (glassy-winged sharpshooter) (Fig. 2). This vector feeds on many woody and herbaceous plants and can transmit *X. fastidiosa* strains that cause PD. *Oncometopia* spp. (Fig. 3) are also important vectors of *X. fastidiosa*. In 2003 and 2004, a survey for principal leafhoppers that transmit PD-associated strains of *X. fastidiosa* was performed in southern counties of Oklahoma. Several important leafhopper species were recovered over the two-year period, but *H. coagulata* and *Oncometopia spp.* were not identified.

Fig. 2. Glassy-winged sharpshooter, *Homalodisca coagulata.* Photo courtesy of Forrest Mitchell, Texas A&M.

Fig. 3. *Oncometopia orbona*. Photo courtesy of Forrest Mitchell, Texas A&M.

Symptoms of BLS are perennial and will appear late in the summer when weather conditions are predominately hot and dry. Typically, chlorosis and green fading colors will develop at the edges of leaves, which dry and turn brown. Marginal browning can take on an undulating appearance as it moves toward the veins of the leaf (Fig. 4A). A yellow to red-brown band may be present between the green and scorched areas of the leaves (Fig. 4A). On oak, BLS symptoms differ from that of oak wilt (**a similar disease caused by a fungus, not yet confirmed in Oklahoma**) in that no band between green and scorched areas of the leaf exists (Fig. 4B). BLS of oak also differs from oak wilt in that it will develop over several years, symptomatic leaves are retained on the tree until autumn , and dark streaks will be absent in sapwood (Fig. 4C). Leaf symptoms of BLS can look very similar to drought stress symptoms, however, the yellow or red-brown band between green and scorched areas will be absent in trees suffering from drought stress (Fig. 4D and E). Leaf symptoms of iron chlorosis look very different from BLS in that the leaf will appear uniformly faded-green in color (Fig. 4F). Initially leaf symptoms of BLS will be noted on a single shoot or at the upper edge of the canopy. Over a period of years, the symptoms will progress throughout the entire canopy and a uniform "thinning" of the canopy will be noted (Fig. 5). Wilting of shoots is not typically associated with BLS.

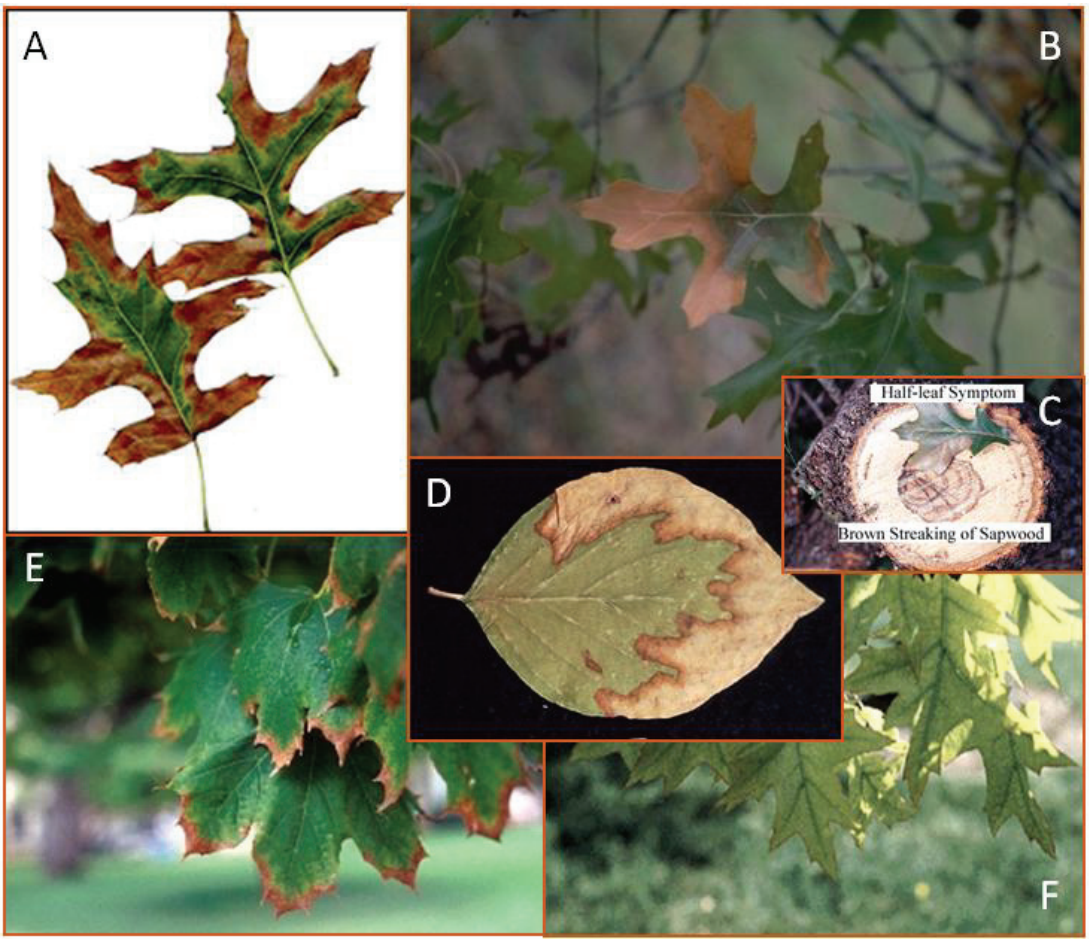

Fig. 4. A, Leaf symptoms of bacterial leaf scorch of oak **B,** Leaf symptoms of oak wilt caused by a fungus **C,** Brown streaking of sapwood as a result of infection by the fungus that causes oak wilt **D,** Leaf symptoms of drought stress **E,** Leaf symptoms of drought stress **F,** Iron chlorosis of oak. Photo credits: www.bugwood.org and the Oklahoma State University Cooperative Extension Service.

Fig. 5. Canopy thinning of a pin oak tree, a typical symptom of advanced bacterial scorch disease.

Unfortunately there is no chemical control or cure for BLS. If BLS is identified in a nursery setting, affected trees should be removed and destroyed. The only way to confirm whether a tree is infected by the pathogen that causes BLS is to submit samples to the Plant Disease and Insect Diagnostic Laboratory (PDIDL). The sample should include a twig with several symptomatic leaves attached. The leaves should be placed within a ziptop bag with no added moisture and mailed to the PDIDL. Be sure to include a **completed** sample form with your sample. Sample forms can be found at http://www.ento.okstate.edu/pddl/pdidl-form.pdf. Any pertinent digital pictures should be sent to jen.olson@okstate.edu. Results for the BLS test are generally available in 3 days.

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