



Issue 404: October 2018

Bacterial Leaf Streak Update

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In 2014, producers in southwestern Nebraska began seeing lesions on corn plants that were unique from other common pathogens. These symptoms looked like Gray leaf spot, but Gray leaf spot is gray or brown in color with straight margins that are restricted by the veins of the leaf. In contrast, these new lesions looked similar except they are brown, red and tan in the lesion and the margins of the lesion were wavy. When a leaf is held up to the sun, yellow halos can be seen around the lesion.

This disease was officially diagnosed in 2016 as Bacterial leaf streak (BLS). This work was done by isolating the bacterium and infecting plants in control situations in the greenhouse. DNA work and comparisons on other host plants identified the bacterial pathogen as *Xanthomonas vasicola pv vasculorum* (Xvv). This was the first time this pathogen had been identified outside of South Africa. Little work had been done with Xvv because it was thought to be cosmetic and the only research that was performed was identifying other host plants. It showed the bacteria also infected sugarcane and bananas. Pathologists in the United States became more concerned when the inoculation levels reached epidemic proportions with some fields having 90% incidence levels with over 50% of the leaf area infected in corn-growing areas of Nebraska, Colorado and Kansas and new diagnoses coming in from Iowa, Illinois, Oklahoma, South Dakota and Wisconsin.



Dr. Kirk Borders, with Colorado State University, thought it was important to accurately identify the causal agent and identify its relationship to the strains of Xvv from South Africa. He also had some strains sent from Argentina from fields that were suspected to be infected with Bacterial leaf streak. These fields had expressed symptoms like BLS since 2010 but the disease had never been officially identified. Bacteria was isolated from symptomatic leaves, sent to Dr. Borders lab, and seven of the isolates were confirmed to be Xvv. The official identification was only recently determined but it is important to note that since 2010 all nine maize producing provinces of Argentina are reporting BLS symptoms.

To better understand the evolutionary process, 23 isolates were collected from corn in the U.S., South Africa and Argentina and compared to isolates from sugarcane, sorghum and *Tripsicum laxum*, which is a native relative to corn. This research showed that the isolates from corn in the U.S., Argentina and South Africa formed a distinct genetic group compared to the isolates from sugarcane and *T. laxum*. They also found that there was greater diversity from isolates obtained from Argentina, suggesting that BLS has been there longer than suspected. Recent research concluded that the U.S. infection likely came from Argentina. This brings about the question of whether Xvv can be transmitted on seed. Iowa state University has been performing test on this, and the tests have been inconclusive so far, but they feel

that the infection level may be very low and potentially may be as low as one in several thousand seeds, requiring more time for testing.

Environmental conditions appear important for the development of this disease because it is the most severe in semi-arid regions under pivot irrigation systems where corn-on-corn is grown. The infection occurs as early as the V4 growth stage from the bacteria being splashed onto the lower leaves by rain or irrigation water. The bacteria grow and develop into the upper canopy when water is applied through irrigation or by rain. Long distance dispersal has been observed in fields where there is no sign of early or mid-season infections and these infections generally occur after strong storms and heavy rain. It is thought that this situation creates an aerosol containing the bacterium that moves with the storm systems and the bacteria infect the corn plant through the stomata. The environmental conditions in western Nebraska, Kansas and Colorado are optimal for development of *Xvv*.

One important portion that needs to be discussed is where the inoculum comes from. Studies have looked at how well the bacteria survive on corn residue. Inoculated leaves have been buried in the soil four to six inches deep in nylon bags compared to inoculated leaves left on the soil surface in similar nylon bags. It has been found that when the leaves are broken down and the leaf residue breaks down the bacteria population diminishes. Leaf samples left on the soil surface supported the bacteria for multiple months if leaf material is present. This supports the theory that tillage helps reduce the initial source for the bacteria and will help reduce BLS in the field. Another study looked at alternative hosts for *Xvv* and the results of this study were concerning. UNL graduate student Terra Hartman inoculated 34 different plant species in an inoculation chamber with *Xvv* and left them overnight. Oats, rice, big bluestem, little bluestem, indiangrass, orchardgrass, timothy, bristly foxtail, green foxtail and yellow nut sedge all showed symptoms the next day. The researchers were concerned that the greenhouse environment created a perfect environment for the bacteria to infect the plants. These species were tested near an infected field and bristly foxtail and big bluestem were susceptible in a natural environment.

There are limited ways to control BLS in the field. There are no chemicals that can be utilized because *Xvv* is a bacteria and fungicides are ineffective. There are some bactericides that may offer control, but frequent rains or irrigation wash them off making the need for reapplication resulting in high cost. Culture control can offer some control, but more research needs to be performed and alternative hosts may make this option limited. The best control will come from plant resistance. This has been used in other crops such as sorghum and has proven to be very effective. Research is currently being performed looking for loci that are involved in the control BLS using molecular markers. Loci have been identified but inheritance is low because of multiple minor genes or linkage groups in maize to date.

It should be noted that the American Phytopathological Society is dedicating its May Journal to all Bacterial leaf streak research because of the limited knowledge of this disease.

Observations from the field have shown that corn hybrids vary on their tolerance to this pathogen. Contact your local LG Seeds TTA for more information.

Resources and additional information:

<https://www.nebraskafarmer.com/wheat/research-identifies-new-hosts-bacterial-leaf-streak>

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