Agronomic Spotlight

Bacterial Leaf Streak in Corn

- A bacterium in the genus Xanthomonas, causing a foliar disease of corn known as bacterial leaf streak (BLS), has been found in corn fields throughout Nebraska and in additional neighboring states.
- Symptoms of the disease resemble other corn foliar diseases, including gray leaf spot and southern corn leaf blight.
- There is no evidence that the BLS pathogen is seed-borne or that it colonizes vascular tissues thus causing a vascular wilt.
- Where it occurs in South Africa, BLS has been associated with crop residue-borne inocula, overhead irrigation, and warm temperatures; impacts on yield usually have been minimal.

A new bacterial leaf disease of corn has been found in Nebraska and in additional neighboring states in 2016. Similar symptoms were observed in these areas each of the past few seasons and an isolated incident may have occurred as early as 2005. The United States Department of Agriculture recently confirmed that the symptoms are caused by Xanthomonas vasicola pv vasculorum as documented by a team of plant pathologists from Colorado State University, Kansas State University, and University of Nebraska-Lincoln. Xanthomonas vasicola pv vasculorum is also known as X. vasicola pv zeae and as X. campestris pv zeae. This bacterium is the causal agent of bacterial leaf streak (BLS), a corn disease of relatively minor importance in South Africa where occurrence is sporadic and limited geographically.

Fig.1. Symptoms of bacterial leaf streak (BLS) disease on lower leaves.

The BLS pathogen presumably survives in previously infected host debris. Bacterial exudates found on surfaces of infected leaf tissues can serve as secondary inocula. There is no evidence that the disease is seed transmitted. The bacterium is spread by wind, splashing rain, and possibly by irrigation water. The pathogen penetrates corn leaves through natural openings such as stomata, which can result in a banded pattern of lesions occurring across leaves. Colonization of leaf tissues apparently is restricted by main veins. The pathogen does not appear to routinely invade vascular tissues; thus it does not cause a vascular wilt similar to the Goss wilt bacterium, Clavibacter michiganesnis nebraskensis, or the Stewart's wilt bacterium, Pantoea stewartii. In this regard, it is much more similar to another bacterial leaf disease of corn, bacterial leaf blight (BLB) caused by Acidovorax avenae. The disease appears to increase with irrigation during hot weather (>90 °F).[1] Impacts on yield have not been documented although severity of foliar symptoms have approached 40% leaf area infected on susceptible products.[2] Because it appears to be entirely a foliar pathogen and does not infect plants systemically or cause a vascular wilt, it is highly unlikely that BLS will have an impact on yield similar to that of Goss's wilt.

Fig. 2a and 2b. BLS symptoms: translucent, water-soaked streaks between veins (left). Elongated streaks of BLS lesions restricted by main veins (right).

Figs. 3a and 3b. Lesions of BLS coalesce as leaf tissue dies creating large areas of necrosis.

Symptoms

Symptoms occur at any stage of corn growth but typically have been observed first on lower leaves (Fig. 1) with spread to the middle and upper portion of the crop canopy after flowering. Initial symptoms first appear as translucent, water-soaked streaks between veins (Fig. 2a, 2b) and progress to longer yellowish to necrotic steaks that can coalesce to form larger areas of symptomatic tissue (Fig. 3). Bacterial exudates on the leaf surface may appear as small, dried, yellow-colored droplets (Fig. 4).

Fig. 4. Dried droplets of bacterial exudates on leaf surfaces.

Diseases with Similar Symptoms

Symptoms of BLS (Figs. 5a and 5b) are similar to those of at least four other foliar diseases of corn: GLS - gray leaf spot (Fig. 6), SCLB - southern corn leaf blight (Fig. 7), NCLS3 - northern corn leaf spot race 3 (Figs. 8a and 8b) and BLB - bacterial leaf blight, caused by Acidovorax avenea (Fig. 9). Of these four diseases, GLS is most likely to occur in areas where BLS has been found recently. SCLB and BLB are more likely to occur in warmer areas of the southern United States. NCLS race 3 is more prevalent in cooler, northern regions.

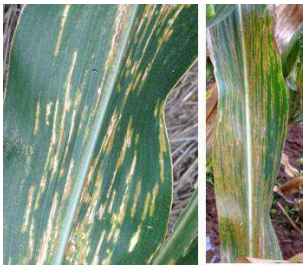

Fig. 5a and 5b. Typical symptoms of the bacterial leaf streak (left). Symptoms on a susceptible corn product (right).

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Compared to GLS, lesions of BLS tend to have edges that are more “wavy” or slightly less well defined by leaf veins (compare Fig. 5a to Fig. 6). Also, on many products, lesions of GLS are likely to be shorter than those of BLS. Symptoms of BLS are likely to appear in fields in early to mid-June, about 2 to 3 weeks earlier than those of GLS.

Care should be taken to properly distinguish between these diseases. BLS can be differentiated from the fungal diseases by bacterial streaming also known as an ooze test (Fig. 10). If uncertain, samples should be submitted to a plant diagnostic center for verification of the disease.

Management Options

Because the disease is new to North America, research on management options for BLS has not been investigated thoroughly; however, recommendations can be based on general knowledge about the pathogen and information from South Africa.

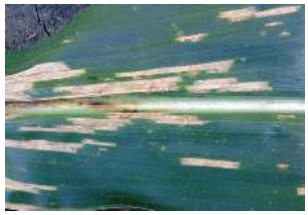
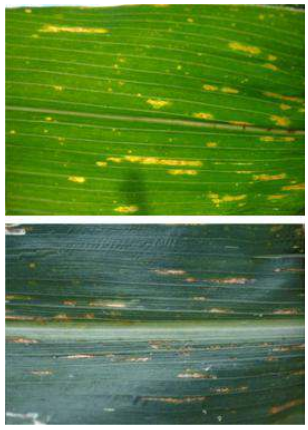


Fig. 6. Rectangular lesions of gray leaf spot (GLS) resemble BLS. GLS lesions tend to have borders that are delineated by leaf veins with sharper edges than those of BLS.

Fig. 7. Elongated, oval lesions of southern corn leaf blight (SCLB) with wavy edges that are roughly defined by leaf veins can resemble those of BLS.



Figs. 8a and 8b. Symptoms of northern corn leaf spot race 3 caused by Bipolaris zeicola race 3 (Syn: Helminthosporium carbonum race 3): a series of consecutive small oval lesions limited by leaf veins having a “string of pearls” type appearance resemble symptoms of BLS.

- Field sanitation and tillage and/or crop rotation could reduce the occurrence of BLS since the pathogen is residue borne.
- As with other bacterial diseases of corn, such as Goss’s wilt, FUNGICIDES ARE NOT EFFECTIVE. Hence, proper identification of the disease, particularly differentiation from GLS, is necessary to avoid application costs of ineffective fungicides.
- A range of reactions occurs among corn products, but because of the recent occurrence and identification of the BLS, few commercial products are definitively characterized. In South Africa, most products have adequate levels of resistance to prevent a substantial impact of BLS, and the few susceptible products were withdrawn from the commercial market.[2]
- Because the BLS pathogen can be transferred, equipment should be cleaned between fields to prevent further spread. Contact your local university extension specialist for sanitation guidelines.

Fig. 9. Symptoms of BLB caused by Acidovorax avenae closely resemble those of Xanthomonas although BLB lesions often have more sharply delineated margins.

Sources

[1]Qhobela, M. Claflin, L. E., Nowell, D. C. 1990. Canadian J of Plant Pathology 12:183-186.
[2]Jardine, D.J. and Clafin, L.E. 2016. Compendium of Corn Diseases, 4th edition. Web sources verified 7/25/16. 160721094852.

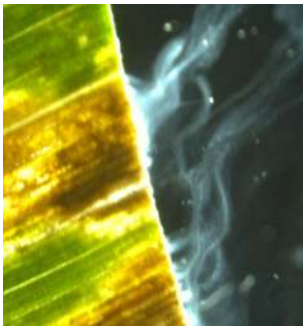


Fig. 10. “Ooze test” - bacterial cells stream from BLS-infected leaf tissues when placed in a drop of water and examined under a microscope. In some cases, bacteria can be seen streaming from severely infected tissues when cut edges are place in a clear glass of water.