



DISEASES OF CORN

Tar Spot

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Tar spot of corn (caused by the fungus *Phyllachora maydis*) was first confirmed in the United States in 2015 on dent corn in seven counties in northwest Indiana and 10 counties in north-central Illinois. The disease was detected very late in the growing season and no yield loss was reported in fields where the disease was first confirmed. In 2018, a yield-reducing epidemic of tar spot occurred in northern Indiana and in surrounding states. Following this epidemic, tar spot was detected in 172 counties across six states in the Midwest (Kleczewski et al., 2019). Tar spot was confirmed in 38 Indiana counties in 2018 (Figure 1). Fields in the most severely affected regions reached 100% disease incidence and over 50% severity on the ear leaf before the dent growth stage (R5/R6) with reports of 1345-4035 kg/hectare (20-60 bu/acre) yield loss.

Our knowledge of how to economically and sustainably manage this new disease is limited, but it is important to understand how to identify tar spot if it appears on your farm.

This publication describes:

1. How to correctly identify tar spot
2. Conditions that favor disease development
3. The disease's potential impact

Tar Spot Distribution

■ 2018 Positive Confirmation

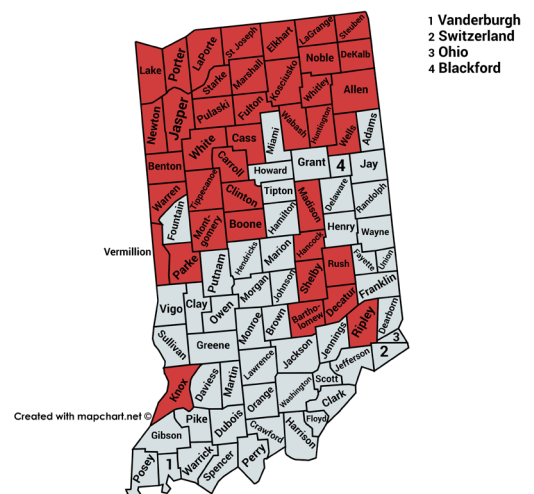


Figure 1. In 2018, tar spot was confirmed in 38 Indiana counties: Allen, Bartholomew, Benton, Boone, Carroll, Cass, Clinton, Decatur, DeKalb, Elkhart, Fulton, Hancock, Huntington, Jasper, Knox, Kosciusko, LaPorte, LaGrange, Lake, Madison, Marshall, Montgomery, Newton, Noble, Parke, Porter, Pulaski, Rush, Shelby, St. Joseph, Starke, Steuben, Tippecanoe, Vermillion, Warren, Wells, White, and Whitley.

Identification

While a preliminary identification of tar spot can be made visually, a laboratory diagnosis is required to distinguish it correctly from other pathogens. Leaves with tar spot have small, raised black and circular spots, which are fungal structures called stromata (Figure 2).

Stromata can be present on healthy or dead tissue of leaf sheaths, stalks, and husks. Stromata can be surrounded by a narrow tan halo, which is known as a fish-eye lesion (Figure 3). The stromata are raised and bumpy, and vary in shape from small pinhead structures to more elongated structures.

Infection of tissues can vary from light to heavy depending on the amount of the pathogen in the field, the environment, and the hybrid (Figure 4).

It is easy to confuse stromata with structures associated with other fungal diseases, such as the black pustules that the corn rust pathogen produces as it ages. A laboratory diagnosis is required to distinguish tar spot stromata from rust pustules or other pathogens. In Indiana, you can submit a sample to the Purdue Plant and Pest Diagnostic Laboratory ppdl.purdue.edu.

Tar spot can also be easily confused with the black saprophytic organisms that grow on dead leaf tissue. However, saprophytes usually have a dusty appearance and you can rub them off the leaf tissue. (Tar spot stromata cannot be rubbed off.)

Favorable Conditions

Most of the information we have about tar spot originated in Mexico and Central America, where favorable environmental conditions make the disease prevalent. In these areas, cool (59-70°F), humid conditions (85% relative humidity) with long periods of leaf wetness (greater than 7 hours) promote infection and disease development. Wind-driven rain and storms can spread spores of the pathogen to new plants and spread the disease.

The fungus that causes tar spot is an obligate pathogen and requires a living host to grow and reproduce. Researchers believe that the fungus is surviving over winter in Indiana on infected corn debris on the soil surface within stromata. Other fungi related to the tar spot fungus overwinter in a similar fashion by infecting grasses and weeds. It is unknown how long the fungus will survive in this debris outside



Figure 2. The tar spot fungus *Phyllachora maydis* produced raised, black fungal structures called stromata on leaves, stem, and husk of the affected corn plant.



Figure 3. Tar spot stromata can be surrounded by a narrow tan halo.



Figure 4. Leaves affected by tar spot can have densely packed fungal structures.

a living host or the range of hosts the pathogen can infect, although it is assumed to only infect corn. Researchers do not believe the tar spot fungus is seedborne, although it can infect husks, as mentioned above.

Potential Impact

It is still unknown what future impact tar spot could have in the United States, but we speculate that the disease will continue to occur and spread. Some corn fields in the most severely affected Midwestern states (Indiana, Illinois, Michigan, and Wisconsin) reached 100% disease incidence and 50% severity on the ear leaf before the dent growth stage (R5), with reports of 20-60 bu/A yield losses in 2018 (Telenko, personal communication). Yield loss was associated with an early, rapid senescence that led to reduced ear size, poor kernel fill, and vivipary (a condition in which the seed germinated while still on the cob). Preliminary observations also suggest that stalk rot and lodging were increased with high tar spot severity. The rapid senescence could also reduce forage quality.

Tar spot is considered the most important foliar disease in Latin America, particularly Mexico. In Mexico and Central America, *P. maydis* is not widely considered to cause economic damage when present alone, although there were isolated reports of damage in old literature. However, significant yield losses were reported from the tar spot complex, consisting of *P. maydis* and another fungus (*Monographella maydis*) associated with tar spot.



Figure 5. Both hybrids infected with tar spot were in adjacent plots. The hybrid on the left had increased tar spot severity (>40%) leading to rapid senescence, while the hybrid on the right had decreased severity (25%) and remained green longer.

***Monographella maydis* was not detected in any U.S. tar spot samples from 2015 to 2018.** However, 2018 observations indicate that the secondary fungus is not required to cause damage. Here in Indiana, *P. maydis* alone can cause yield loss under favorable environmental conditions. Farmers need to monitor fields in order to help track this disease and determine if management tactics are warranted.

Management Options for Indiana

Hybrid Resistance

The most popular and effective tool for managing tar spot in Latin America is to plant hybrids with resistance to the disease. In 2018, tar spot symptoms were observed across a range of hybrids in Indiana. All of these hybrids were susceptible to tar spot infection, but disease severity, the formation of halos or fisheyes, and rapid senescence varied greatly (Figure 5), and some hybrids appeared more resistant to the disease. Data indicated that no particular seed company brand outperformed others.

Crop Rotation and Sanitation

Any practice that reduces infested corn residue and encourages decomposition of fungal survival structures has the potential to reduce the negative impacts of tar spot compared to fields not implementing these practices. Two of the most common practices for reducing local disease inoculum include crop rotation and tillage.

Rotating away from corn allows infested corn residue to decompose. However, the amount of time a previously affected field must be rotated away from corn previously infected with tar spot is unknown. Similarly, tillage should bury inoculum and reduce local spore dispersal within a field.

Currently no studies have examined the impacts of these practices on tar spot in the United States.

Fungicide

Several fungicides in preliminary fungicide trials may reduce tar spot. In addition, several 2(ee) labels that can manage tar spot will be available starting in 2019. However, there is little information on optimum application timing or if a fungicide application will be effective and economical.

Efforts are underway to try to gain a better understanding of the biology and epidemiology of tar spot. This information will help farmers formulate fungicide application decisions in the future.

If you suspect tar spot is present in an area, submit corn samples to a National Plant Diagnostic Network university diagnostic lab for diagnosis (<https://www.npdn.org/home>). In Indiana, contact the Purdue Plant and Pest Diagnostic Laboratory (PPDL) for information about collecting and processing samples: ppdl.purdue.edu.

Citations

Kleczewski, N. M., Chilvers, M., Mueller, D. S., Plewa, D., Robertson, A. E., Smith, D. L., and Telenko, D. E. (2019). Corn disease management: Tar spot. Crop protection network CPN 2012-W.

Acknowledgments

The authors would like to thank Dr. Kiersten Wise and Gail Ruhl for their contribution to the previous version of this publication (BP-90-W), Nathan Kleczewski and Damon Smith for providing peer-review, and the Indiana Corn Marketing Council for their support.

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