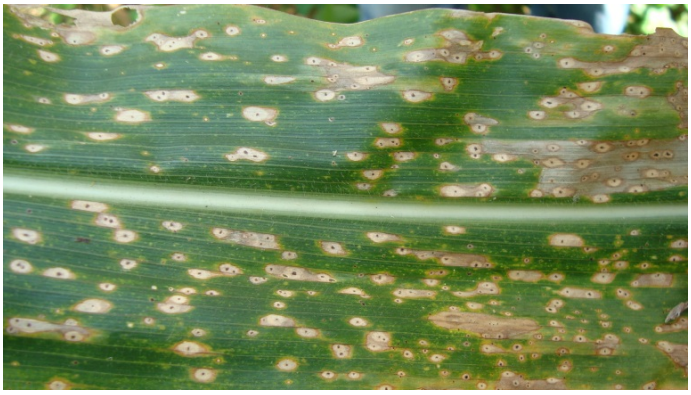
CROP FOCUS

Tar Spot Complex in Corn

Disease Facts

- Tar spot complex in corn is caused by the fungus *Phyllachora maydis* and *Monographella maydis* and has been historically found at high elevations in cool, humid areas in Latin America. Originally observed only in high valleys in Mexico, it has proliferated and spread to South American tropics and parts of North America.
- The two types of fungi can cause different corn yield effects, with *M. maydis* having a significant economic impact within South America. *P. maydis* is the fungal strain present in both South America and North America, and has not been associated with yield loss. Both fungi are commonly found on the surface of maize leaves.



A corn leaf demonstrating "fish-eye" symptoms of tar spot complex

Identification and Symptoms

- Initial symptoms include brownish lesions on leaves. Tar spot is the physical manifestation of the fungal fruiting body, the ascomata, developing on the leaf.
- The ascomata looks like a spot of tar, developing black oval or circular lesions on the corn leaf. The texture of the leaf becomes bumpy and uneven when the fruiting bodies are present. These black structures can densely cover the leaf, and may resemble the pustules present on leaves due to rust fungi.
- Some spots can enlarge around the ascomata, with a necrotic area developing out of a water-soaked brown lesion, developing a "fish-eye" symptom (Hock et al., 1992), where the ascomata is surrounded by a brown ring.
- The larger lesions can coalesce after 7-14 days and areas between spots can become water-soaked and dry out. Tar spot spreads from the lowest leaves to the upper leaves, leaf sheathes, and eventually the husks of the developing ears (Bajet et al., 1994).
- The host reaction to each fungus can be differentiated; *P. maydis* alone produces small, round, dark lesions, and *M. maydis* causes the brown necrotic ring. Together, they produce the "fish-eye" symptom.

Brownish lesions can cover a significant amount of the plant, and cause necrosis in the leaf tissue

Disease Cycle

- The initial source of inoculum for both fungi is not determined. *P. maydis* and *M. maydis* only infect corn, and are not known to be seedborne, so they might be transported on fresh or dry corn leaves or husks, from which asci and ascospores would be produced and carried by physical forces.
- *P. maydis* and *M. maydis* appear to have windborne spores, and tend to release them in periods of high humidity. In a research study, the fungus was able to spread up to 75 meters away from infected plants with high levels of environmental humidity during the evening hours (Hock et al., 1995).
- *M. maydis* is commonly found on the surface of corn leaves, and usually is asymptomatic, because it is only in association with *P. maydis* that *M. maydis* can develop signs of tar spot. *P. maydis* in association with *M. maydis* causes the fungus to become pathogenic and highly virulent.
- Disease development generally starts at flowering time, where visual symptoms of tar spot complex can be observed. However, infection in the leaves can occur as early as the V8 to V10 leaf stage (Hock et al., 1995).
- Lesions appear on the lower leaves and move rapidly up the plant, with the development of *P. maydis* lesions followed by *M. maydis* lesions; both of which will increase the amount of leaf area affected.
- Under favorable environmental conditions, which are cool temperatures (16-20 ºC, 60-70 ºF) and high relative humidity, the leaves from infected corn plants can be completely covered in tar spot 3 to 4 weeks after flowering (Bajet et al., 1994).

Impact on Crops

- Up to 4000 lesions on a leaf have been observed, affecting up to 80% of the leaf area (Ceballos and Deutsch, 1992).
- In susceptible genotypes or where conditions favor the disease, the plant can have little to no green area, affected ears can have reduced weight and loose kernels, and kernels at the ear tip may germinate prematurely (CIMMYT, 2003). A toxin produced by *P. maydis* has been associated with rapid plant tissue death. (Ceballos, 1992)
- To cause serious damage or to affect potential yield, two fungi must be present together, as *P. maydis* and *M. maydis* work in conjunction to produce significant economic damage by increasing the leaf area affected. Only *P. maydis* is known to be present in the United States.
- In Mexico, the tar spot complex has been associated with yield losses of up to 30%, with an average yield loss over several years in affected areas at around 8% (Hock et al., 1995).
- Greater losses are possible if environmental conditions are favorable or hybrids grown are highly susceptible to fungal infection. If the fungus infects the corn before flowering, the impact in yield can be more significant as well.
- *P. maydis* was first identified in the United States in 2015 in Illinois and Indiana. It is believed that spores were blown in by a weather system originating in Mexico.
- The potential for corn yield loss associated with the tar spot complex in the United states is unclear at this point, although no instances of yield loss associated with *P. maydis* have been documented to date. *P. maydis* is not known to cause yield loss in the absence of *M. maydis,* which has not been found in the United States.

Management Considerations

- Caution must be exercised when identifying tar spot complex, because it may appear similar to other pathogens. Corn rust has a black phase, where the overwintering teliospore develops. Saprophytes that feed on dead corn tissue can form black splotches on leaves.
- Tropical rust is also often mistaken for tar spot, since the structural characteristics of the symptoms of both fungi are similar.
- If a grower suspects that tar spot might be present, lower leaves should be examined for small, raised, dark, glossy and circular or oval spots, or to look for brown lesions having a dark ascomata at the center (CIMMYT, 2003).
- Chemical control and fungicide treatments can be effective against the spread of tar spot. A fungicide applied before flowering has been shown to be the most effective in field plot tests in Mexico, if applied every ten days (Bajet et al, 1994). No fungicides are currently registered for tar spot control in the United States.

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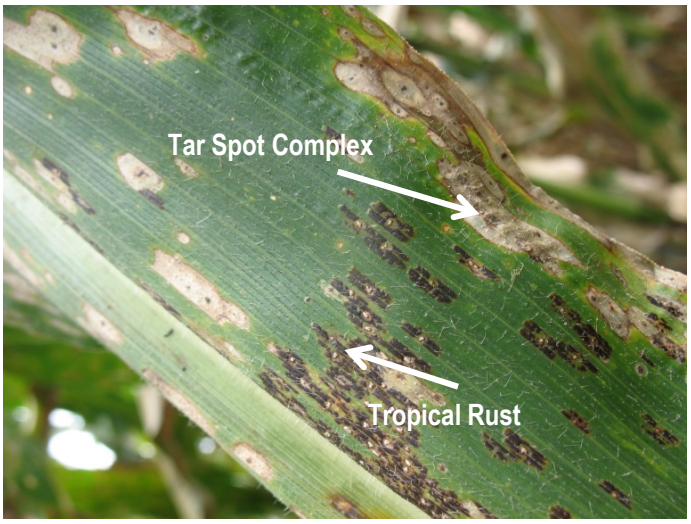
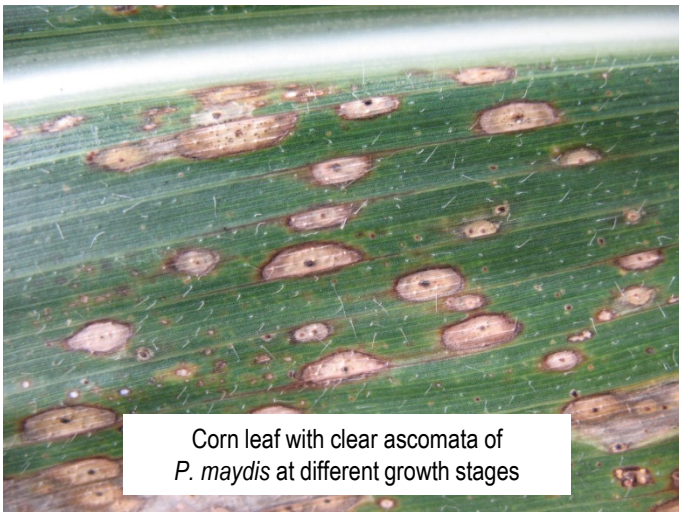


Tropical rust can appear in conjunction with tar spot complex.



Corn leaf with clear ascomata of *P. maydis* at different growth stages

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