Getting a Handle On Phomopsis

NSA-University-USDA Partnership Gets More Aggressive

Ask a political candidate running for national office about their thoughts on climate change, and you are likely to get an earful. Whatever your thoughts on climate change, there is little debate that the northern production region of the Dakotas and Minnesota has been wetter than normal over the last five years. The wet environment has been conducive to more diseases on crops, and sunflower is no exception.

One disease that has surfaced throughout much of the production region during this wet cycle is Phomopsis stem canker. Moderate temperatures combined with frequent rainfalls appear to be the right formula for this disease to develop.

Phomopsis stem canker was first observed in Europe in the early 1980s and nearly devastated the industry there. The disease was first observed in the United States in 1984. The National Sunflower Association has conducted an annual crop survey for the past 10 years using volunteer scientists and others to conduct intensive random field surveys. Data from these surveys going back to the 2002 crop year show a very small percentage of the crop with this disease. But starting in 2006, Phomopsis incidence increased steadily in most states, with near-epidemic proportions in 2010. (See chart on next page.)

The fungus proliferates in the stem and overwinters in infected plant debris. Spores are released in the spring/early summer and are either wind-blown or rain splashed onto the leaves of developing sunflower plants.

The fungus spreads through the veins of the leaf to the petiole and eventually to the stem. Once Phomopsis reaches the stem, large brown lesions develop, which are usually visible around or after bloom. The lesions continue to grow and eventually girdle the stem and also cause the pith to disintegrate. The hollow stem, due to rotten pith, weakens the stalk, making it prone to lodging. Under severe conditions, the developing seeds in the head are starved of nutrients, resulting in early senescence and yield loss.

It is important to recognize the difference between Phomopsis canker, Sclerotinia mid-stalk rot and Phoma (photos at left). The Phomopsis canker is large and often five to six inches in length. It is brown rather than black (as in Phoma) and not light gray (as with Sclerotinia mid-stalk rot). The canker always surrounds a decayed petiole. The infected stalk at the lesion can be crushed with moderate thumb pressure, as opposed to Phoma lesions which remain hard. With mid-stem Sclerotinia, the hard sclerotia bodies are evident when breaking the stem apart.

As Phomopsis became more evident, the NSA Board of Directors, along with research partners from the universities and USDA-ARS, established an aggressive tri-pronged research strategy: (1) determining the identity of the Phomopsis species; (2) breeding for resistance, and (3) determin-

Left: These photos provide a good visual differentiation between Phomopsis (upper left), Phoma (upper right) and Sclerotinia mid-stalk rot (left).

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To get to the bottom of the species issue, the National Sunflower Association has funded a Ph.D. student, Febina Mathew, at North Dakota State University. She is working under the direction of Drs. Sam Markell and Gulya. Her initial task is to determine the species and prevalence of the disease, using samples collected from all of the sunflower-producing states. Mathew has confirmed two species from 2010 samples and will be poring through the hundreds of samples collected from the 2011 crop. She will be growing the two species in the greenhouse to determine virulence. This will be a huge asset for breeders who can key in on the most damaging species.

The second part of the project is to identify genetic resistance. That work got a great boost in 2011 field trials in Minnesota and South Dakota. Gulya tested 260 entries from the USDA-ARS Plant Introduction Station at Ames, Iowa, for tolerance to the disease. There were two entries that had zero disease at all three locations and nine entries with less than 2% infection. Of great importance for breeders is that five USDA advanced lines had from 2 to 4% infection across the three sites. These five lines have already been genotyped in the NSF SNP program, so marker selection will be an available breeding tool.

In addition Gulya tested 73 private company hybrids in two of the trials. Most of the hybrids are assumed to be experimental. Infection across the two trials ranged from 1 to 28%. There were 13 hybrids with infection rates of 5% or less, representing five different companies.

Gulya was pleased with the results. “The private companies have some excellent material in their breeding programs, and the USDA advanced material looks very good,” he notes. “In addition, we have a good deal of germplasm to select from the Plant Introduction Station.” The key now is the work being completed by Febina Mathew to determine how many species of the disease are out there and to ensure we have resistant genes for all species. — Larry Kleingartner

Mark Your Calendar!

2012 NSA Summer Seminar
June 26-28
Arrowwood Resort
 Alexandria, Minn.

Febina Mathew, a North Dakota State University graduate student, has confirmed two different species of Phomopsis from 2010 samples and is now examining 2011 samples. Greenhouse growouts will help determine the species’ virulence.