Pest e-alerts

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Update on Black Leg Disease of Canola

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Black leg causes both leaf spots (Fig. 1) and stem cankers (Fig. 2) on canola plants. The leaf spot phase of the disease itself does not cause yield loss, but damaging stem cankers, capable of reducing yield by up to 50%, develop at the base of stems on leaf scars where infected leaves were attached. Black leg was first identified in canola in 2009 in a field in northern Oklahoma. Since then the disease has been found in most areas where canola is grown.

Fig 1. Leaf spot phase of black leg disease of canola.

Fig 2. Stem canker phase of black leg disease of canola.

The fungus survives on the stubble (plant stalks) left in the field following canola harvest where it undergoes sexual recombination each year. The results of the recombination are airborne ascospores (Fig. 3) that are released into the air and capable of directly infecting leaves of the subsequent crop when conditions (leaf wetness) are favorable for disease development. Clonal asexual spores called conidia are produced in leaf spots and young stem cankers that are spread by water (Fig. 4). The role of these spores in disease development is unclear in that they are not spread long distances and appear to require wounding for infection.

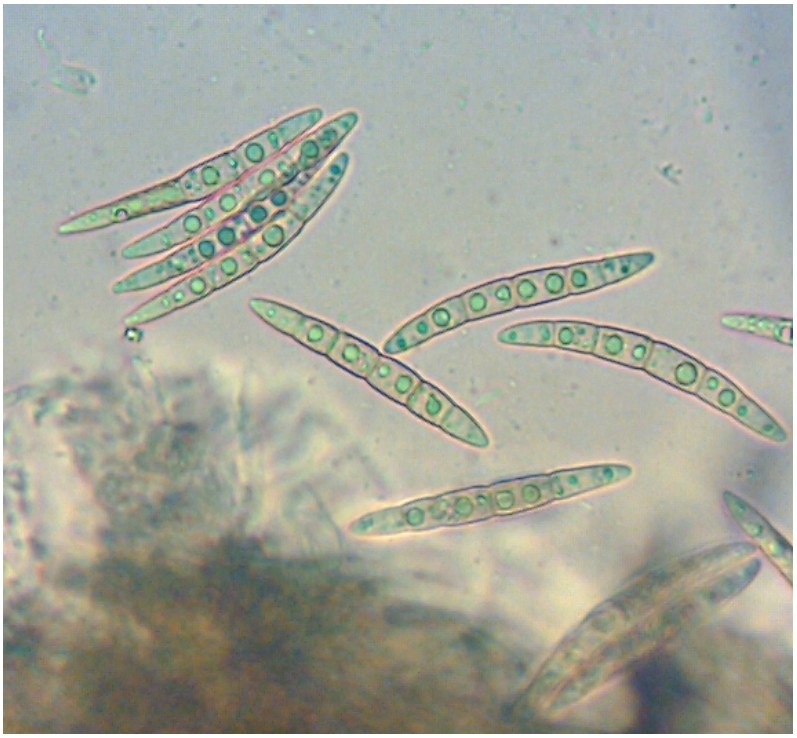

Fig 3. Airborne ascospores produced on canola stubble.

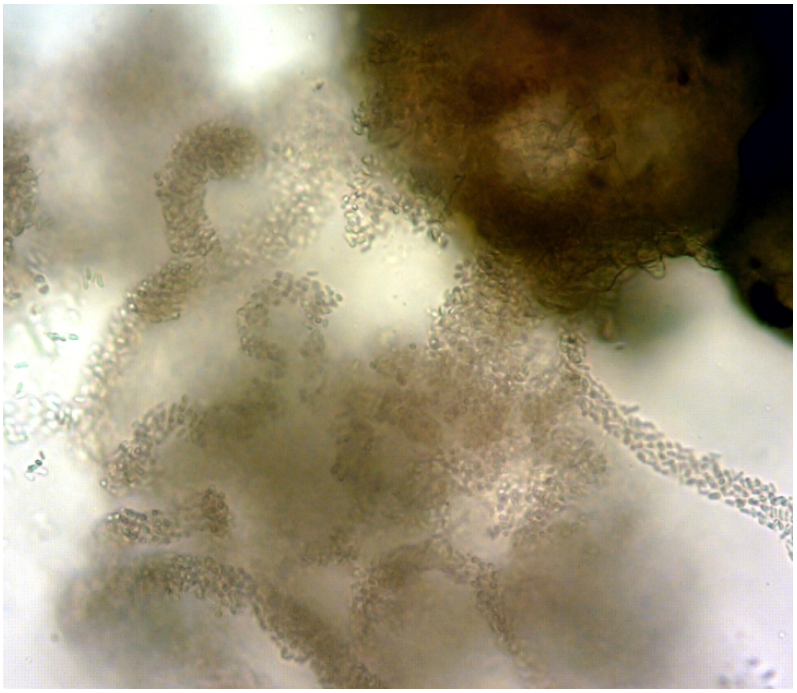

Fig 4. Waterborne conidia produced on leaf spots and stem cankers.

The past three summers have been unusually dry which may have delayed the development of ascospores in stubble. Despite the warm and wet conditions last fall and winter, leaf spots did not appear until March and April when they were widespread. Cankers become more severe when plants are infected in the fall compared to the spring. This week I examined some stubble from our plots in Payne Co. and from a field in Alfalfa Co. to assess ascospore development. Most of the fruiting bodies picked off the stubble were producing conidia, and none were producing ascospores. There were some early signs of ascospore initials, but I am not sure how long the develop time will be until ascospores are mature. I am concluding that we will be looking at late infections again this year. The fungicides Abound and Proline, registered for use on canola, have been most effective in reducing black leg levels in experimental plot. However, due to the late disease development during in the last two crops, we have yet to document a significant yield response to any fungicide program tested.

The ideal management strategy for black leg is to plant a variety with resistance to the disease. There are two approaches in development of resistant varieties. The first involves the use of single gene resistance to leaf spot as identified on seedling plants. This approach is effective because the seedling test is quick and inexpensive, and the resistance conferred is high. The down side to this approach is that because of sexual recombination by the fungus each year, the fungus may overcome the resistance. Loss of resistance to the disease has occurred in Europe and Australia over the last 10 years. Considerable research has been done there to identify resistance genes and prevailing strains of the fungus. Up to 12 resistance genes have been identified in European and Australian varieties. The second approach to breeding resistant varieties is to screen for stem canker resistance in the field. Reduced stem canker severity is apparently controlled by multiple genes, making resistance difficult to incorporate into new varieties. Furthermore, the identification of resistant varieties and breeding lines in field screening trials is expensive and sometimes unreliable. Little information is produced from large screening trials when disease pressure is low. Varieties with multi-gene resistance are often not completely resistant and may suffer yield loss when conditions favor severe disease development. On the positive side, multi-gene resistance is durable and not readily overcome by new pathogen races. Canola varieties currently grown in the southern Great Plains have been screened for reduced canker severity in national screening trials done in Georgia for many years and now in Oklahoma.

Because *Leptoshaeria maculans* is so variable, the North American strains of the pathogen have been classified into pathogenicity groups (PG) of 1 to 4 based on the ability to produce leaf spot on the cotyledons of young plants (Fig. 5) using a set of three differential varieties (Table 1). The susceptible (+) reaction consists of large leaf spots containing signs of pathogen reproduction (fruiting bodies; Fig. 5). Various intermediate reactions often occur but are considered resistant (-) reactions.

Fig 5. Disease reactions observed in the seedling test for determining Pathogenicity Group (PG). Left: resistant reactions, Right: susceptible reactions.

Table 1. Pathogenicity groups (PG) of the black leg fungus (*L. maculans*) in North America based on seedling reactions of three canola varieties (- = resistant reaction, +=susceptible reaction)[1].

PG	Westar	Glacier	Quinta
1	-	-	-
2	+	-	-
3	+	+	-
4	+	+	+

[1] "Westar" has no resistance genes, "Glacier" has R2 and R3 resistance genes, "Quinta" has R1 and R4 resistance genes.

Growers have questioned whether or not we have the “bad strains” of black leg in Oklahoma. While “bad” strains would include any strain capable of causing disease on “Westar”, which has no gene for black leg resistance, most perceive the worse strain to be PG4 which attacks all of the differential varieties.

We recently tested 39 isolates of *L. maculans* collected in Oklahoma since 2009 in the seedling test. These were from Caddo, Kingfisher, Alfalfa, Major, and Garfield Counties. Most of the isolates (41%) were PG4, 23% were PG1, 13% were PG2, 1 isolate (3%) was PG3, and 20% gave a variable response or could not be assigned to a known PG group. PG4 was found in each county where isolates were collected.

The significance of these finding in relation to the cultivars we currently grow is uncertain. While resistance to leaf spot should prevent canker development, it is unknown whether or not varieties selected for multigenic resistance to stem cankers in the field have leaf spot resistance in the seedling test. Combining the two forms of resistance could be more effective. The next step is to run the seedling screen with PG4 on all of the varieties and breeding lines we have received from the canola breeder at Kansas State University to test for leaf spot resistance in that material.

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