2020 Tech Bulletin

What is Blackleg Race Testing ?

What is Blackleg?

Blackleg is a disease caused by the fungus *Leptosphaeria maculans* and *Leptosphaeria biglobosa* that affects canola and other oilseeds in the mustard family.

L. *biglobosa*	L. *maculans*
• Weakly virulent • Infects plants late in the season • Rarely causes significant yield loss	• Highly virulent • Infects from the seedling stage onward that progressively damages the crop as the season progresses • Can cause significant yield loss

Table 1: The difference between the two species of blackleg, L. biglobosa and L. maculans.

How does resistance work?

It is important to note that there are two types of resistance: quantitative and qualitative.

Quantitative Resistance	Qualitative Resistance
• Expressed at the adult stage of the plant • Combination of several genes working together to have a relatively small effect on the plant	• Controlled by race-specific resistance gene • Interaction between the pathogen Avr genes and matching resistance (R) gene in the plant. • Interaction causes plant to initiate a defense/ immune system response

Table 2: The difference between quantitative and qualitative resistance.

Canola breeders are likely using both quantitative and qualitative resistance to develop their blackleg resistant varieties.

What are Avr genes and how are they used in choosing a blackleg resistant variety?

If you are looking to use genetics as part of your management strategy for blackleg, it is important to know what races of blackleg are present in your area. L. *maculans* have several different races that can be identified by their avirulent (Avr) genes.

- Avr genes: Found in the fungus, Avr genes are similar to an instruction manual used to make Avr proteins, these proteins play a significant role in causing disease in plants.
- Avr proteins: are distinguishing features that the plant R genes recognize and use to stop pathogen infection.
- R genes: Similar to the Avr genes, R genes are the instruction manual used to create R proteins on the plant.
- R proteins: will recognize the disease and trigger an immune response as a defense mechanism for the plant and stopping pathogen infection.

As mentioned above, qualitative resistance requires an interaction between the pathogens Avr gene and the plants matching resistant (R) gene. It is important to know what Avr genes are present so you can choose the appropriate variety that has the matching R gene.

What is Pathotyping?

Pathotyping looks for the major resistance genes which recognize the Avr pathogen element. Minor resistance is generally a culmination of multiple gene activities that affect the plant's overall health and robustness (eg. stronger cell walls). In human terms, think good diet and clean environment as being like minor resistance.

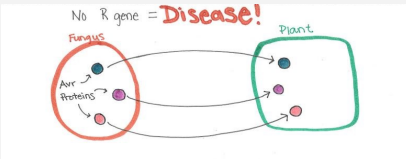

Figure 1: No R gene present in plant. The Avirulent (Avr) proteins present in the fungus are able to enter the plant undetected and cause disease.

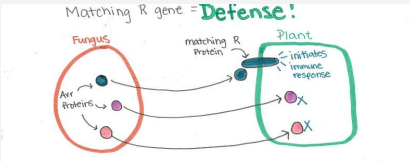

Figure 2: Matching R gene present in plant. The R protein in the plant cell recognizes the Avr protein from the fungus, triggers an immune response and stops the Avr protein from entering the cell.

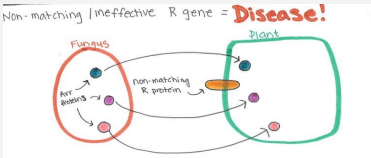

Figure 3: Non-matching/ineffective R gene. The R protein on the plant did not recognize the Avr proteins, allowing them to enter and infect the plant causing disease.

When is the best time to get Blackleg race testing?

Around harvest is the ideal time to pull and inspect plants for blackleg symptoms. When the canola is at 60% seed color change (swath timing) you should cut just below the crown of the plant into the root material to assess. If you see any symptoms of blackleg send the suspected stems to our Nisku lab for testing.

The first thing our lab will do is determine which blackleg species is present, L. *biglobosa* or L. *maculans*.

If L.*maculans* is present our lab will proceed with pathotyping to determine which Avr genes are present. From there you can contact your agronomist/supplier to help you choose the correct variety that will defend against blackleg the next time you have canola in your crop rotation.

Don't forget: you only need one high frequency Avr gene and plant R gene match to stop the infection. There is no need to find a variety that can R match all Avr genes available.

It is important to know that managing blackleg disease of canola in western Canada requires an integrated management strategy. Relying on one strategy alone (such as genetic resistance) is not a viable long term solution.

Visit https://www.canolacouncil.org/canola-encyclopedia/diseases/blackleg/ to learn more about blackleg management in Canada.

To submit samples, request the **Blackleg Tech Bulletin** or for more information contact us at support@2020seedlabs.ca

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