CLUBROOT MANAGEMENT

Clubroot is a costly canola disease that growers need to be aware of and understand the recommended management practices for. The latest research confirms continued spread of the disease throughout the canola-growing areas of Canada. Many new pathotypes are present in the intensive clubroot areas of Alberta where the disease was first identified in Western Canada; however, new pathotypes are being identified in other canola-producing regions. This is a result of too often relying on the protection provided by a hybrid's genetic resistance and ignoring the need for an integrated pest management approach with a diverse crop rotation. It's well documented in clubroot areas that intensive canola rotations are a serious factor in aggravating disease incidence and are creating conditions for new clubroot pathotypes to emerge. These new emerging pathotypes are spreading at a slower rate but still pose a challenge for plant breeders to develop hybrids that provide effective protection against them.

Clubroot Pathotypes

The discovery of new pathotypes capable of overcoming 1st generation clubroot-resistant hybrids has generated a significant amount of research to characterize these pathotypes and identify new sources of genetic resistance. One result of this research is the development of the Canadian Clubroot Differential (CCD) set. Pathotype identification is based on the combination of a number (2, 3, 5, 6, 8) from the Williams' Differential set with a letter (A through Z) from the CCD set.[1] Identification of new pathotypes continues and it is believed that of the 43 pathotypes currently recognized, as many as 25 can overcome 1st generation resistance genes.[2,3]

Certain newer pathotypes such as 3A, 3D and 8E are overcoming the 1st generation resistance genes found in many canola hybrids. The 3A and 3D pathotypes are the most frequently reported clubroot pathotypes where canola hybrids are showing susceptibility. These newer pathotypes are spreading at a slower rate. Adopting hybrids with next-generation clubroot resistance genes as well as appropriate management practices will be key for growers in areas where risk of new clubroot pathotype emergence is high.

Use of 1st and Next-Generation Clubroot Resistance

Clubroot-resistant hybrids should be deployed broadly on all acres. A crop rotation with at least a two-year break between canola crops will alleviate clubroot spore levels and minimize selection pressure. Growing 1st generation resistant hybrids is to be followed up with active disease scouting to monitor hybrid performance and help identify resistance-breaking pathotypes early. If there are known resistance-overcoming pathotypes in the region, growing a next-generation clubroot-resistant hybrid is recommended after a two-year break from canola.

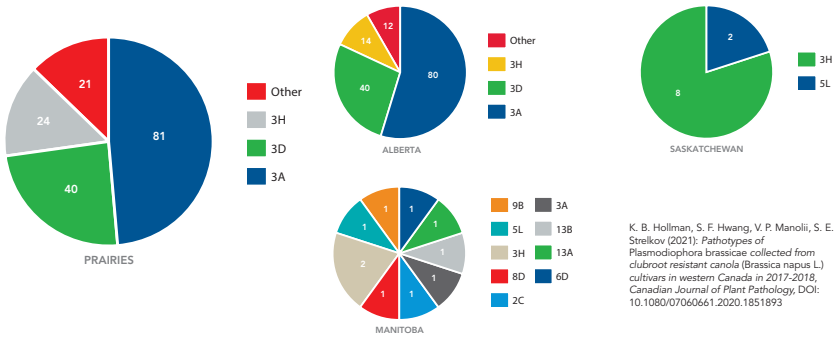
BrettYoung's Clubroot **DefendR®**: Broad Resistance with a Multi-genic Approach

Concurrent with the identification of new pathotypes, breeders have been identifying and incorporating new sources of resistance into the latest canola hybrids. This includes the stacking of multiple sources of resistance to clubroot in hybrids with the Clubroot **DefendR®** trait. This trait has resistance to the older pathotypes that were first identified in Western Canada (2F, 3H, 5I, 6M, 8N) and to many newer pathotypes, including: 3A, 2B, 3D, 8E, 5G, 5K, 3O and 5X. Stacking of major clubroot resistance genes into single hybrids is an important factor on how effective and durable the resistance will be in next-generation clubroot-resistant products.

Recommended Clubroot Management Practices

The Canola Council of Canada (CCC) provides a list of recommendations to manage the spread of clubroot spores by focusing on keeping them low and local.

Growers in areas not impacted by 1st generation resistance-overcoming pathotypes can prevent the accumulation of spores for as long as possible by using resistant hybrids such as BY 6217TF, BY 6207TF and BY 5125CL. Hybrids with the DefendR® clubroot trait are recommended for areas where incidence of resistance breakdown is suspected. Visit **brettyoung.ca/BY6207TF** for further information on performance and its DefendR®-rated, clubroot resistance package.

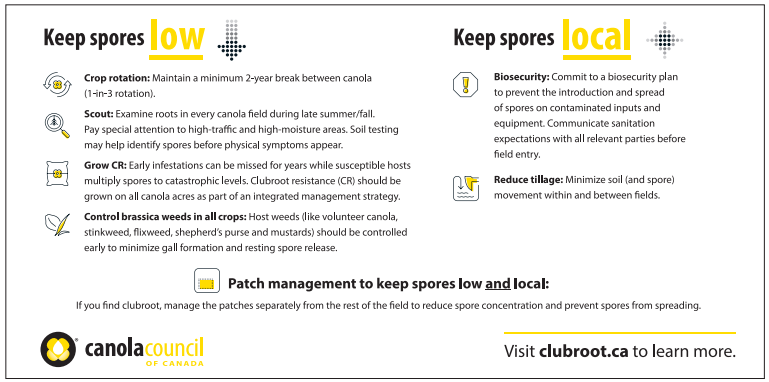


K. B. Hollman, S. F. Hwang, V. P. Manolii, S. E. Strelkov (2021): *Pathotypes of* Plasmodiophora brassicae *collected from clubroot resistant canola* (Brassica napus L.) *cultivars in western Canada in 2017-2018, Canadian Journal of Plant Pathology,* DOI: 10.1080/07060661.2020.1851893

Fig. 1 Prevalence of *Plasmodiophora brassicae* pathotypes across the Canadian Prairies and in the provinces of Alberta, Manitoba and Saskatchewan. Based on collections made from canola crops in 2017 and 2018. One hundred and sixty-six *P. brassicae* field isolates were tested, including 146 from Alberta, and 10 from each of Manitoba and Saskatchewan. Pathotype classifications are according to the Canadian Clubroot Differential set.

1st Generation Resistance
First-generation clubroot-resistant hybrids tend to be hybrids that can trace their resistance genetics to a resistance profile similar to the European-bred winter canola variety, Mendel. These hybrids are typically resistant to pathotypes 2, 3, 5, 6 and 8 (per the Williams' Differential set, which are equivalent to pathotypes 2F, 3H, 5I, 6M and 8N on the CCD set).

Next-Generation Resistance
There is no standard industry definition but in general, next-generation clubroot-resistant hybrids include 1st generation resistance genes but should also contain additional resistance genes that may provide protection against newer pathotypes such as 3A, 2B, 3D, 8E, 5G, 5K, 3O and 5X. Consult the supplier of the variety for specific resistance profile information.



Source: Canola Council of Canada, 2021

[1] Strelkov, S.E., Hwang, S.F., Manolii, V.P., Cao, T., Fredua-Agyeman, R.,Harding, M.W., Peng, G., Gossen, B.D., Mcdonald, M.R., and Feindel, D. 2018. *Virulence and pathotype classification of* Plasmodiophora brassicaepopulations *collected from clubroot resistant canola* (Brassica napus) *in Canada. Canadian Journal of Plant Pathology.* 40:284–298, DOI: 10.1080/07060661.2018.1459851

[2] Askarian, H., Akhavan, A., Manolii, V.P., Cao, T., Hwang, S.F., Strelkov, S.E. 2020. *Virulence spectrum of single-spore and field isolates of* Plasmodiophora brassicae *able to overcome resistance in Canola* (Brassica napus). Plant Disease, 105:43–52, DOI: 10.1094/PDIS-03-20-0471-RE

[3] Hollman, K.B., Hwang, S.F., Manolii, V.P., Strelkov S.E. 2021. *Pathotypes of* Plasmodiophora brassicae *collected from clubroot resistant canola* (Brassica napus L.) *cultivars in western Canada in 2017-2018. Canadian Journal of Plant Pathology.* DOI: 10.1080/07060661.2020.1851893