New Disease Reports

First report of DMI-insensitive *Cercospora beticola* on sugar beet in Ontario, Canada

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Cercospora leaf spot, caused by the fungal pathogen *Cercospora beticola*, is an economically important foliar disease of sugar beet in Ontario, Canada. The first demethylation inhibitor (DMI) fungicide registered for sugar beet in Canada was prothioconazole (PA) in 2006 and fungicides containing difenoconazole (DA), metconazole, propiconazole and tetraconazole (TA) are currently available.

Leaves with Cercospora leaf spot symptoms were collected from twelve commercial sites in September 2016 in the sugarbeet-growing region in Ontario, Canada, which includes c. 3925 ha of sugar beet within an area of c. 300,000 ha in Kent and Lambton counties. Disease severity ranged from approximately 40 to 70% leaf area affected. Field records were only available for half of the locations, but at least one DMI fungicide had been applied during the 2016 growing season at these sites.

Single-conidial cultures of *C. beticola* were prepared and isolate sensitivity was determined by the EC50 (effective control of 50% of germinating conidia) on water agar amended with technical grade DA, fenbuconazole (FA), flutriafol (FL), PA and TA at 0, 0.01, 0.1, 1, 10, or 100 mg/l. The EC50 values were estimated by interpolation of the 50% intercept, based on regression of the arcsine of relative germination versus the log10 transformed fungicide concentration. Isolates showed a similar response based on the spiral gradient dilution method (Förster *et al*., 2004) and a relative growth assay (Fig. 1, only for illustration of dose-response). A total of 31, 32, 34, 30 and 33 isolates were screened against the above fungicides and using a sensitivity threshold of 1 mg/l to identify resistant isolates (Bolton *et al*., 2012), isolates insensitive or resistant to DA, FA, FL, PA and TA were 61, 72, 94, 93 and 97% respectively (Fig. 2). Isolates with EC50 values over 100 mg/l ranged from 26 to 47% for all fungicides. Resistant isolates generally clustered into three groups, those greater with EC50 values greater than or equal to 1 to 5 mg/l, greater than or equal to 10 to 50 mg/l, and greater than 100 mg/l. One possibility is that isolates in each EC50 class have a different genotype, however, this hypothesis needs testing. Isolates showed similar sensitivity response to all fungicides indicating differential cross-resistance amongst isolates to active ingredients in the DMI class of fungicides.

This is the first report of DMI-insensitive *C. beticola* in Canada. Resistance has been reported in other growing regions (Karaoglanidis *et al*., 2000, Secor *et al*., 2010, Trkulja *et al*., 2015). Field resistance of *C. beticola* to DMI fungicides poses a challenge for sugar beet production in Ontario due to favourable conditions for disease and the presence of QoI-insensitive *C. beticola* in the same growing region (Trueman *et al*., 2013), leaving copper and ethylene bisdithiocarbamate fungicides as the only effective tools for disease management.

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References

Bolton MD, Birla K, Rivera-Varas V, Rudolph KD, Secor GA, 2012. Characterization of *CbCyp51* from field isolates of *Cercospora beticola*. *Phytopathology* **102**, 298-305. http://dx.doi.org/10.1094/PHYTO-07-11-0212

Förster H, Kanetis L, Adaskaveg JE, 2004. Spiral gradient dilution, a rapid method for determining growth responses and 50% effective concentration values in fungus-fungicide interactions. *Phytopathology* **94**, 163-170. http://dx.doi.org/10.1094/PHYTO.2004.94.2.163

Karaoglanidis SG, Ioannidis PM, Thanassoulopoulos CC, 2000. Reduced sensitivity of *Cercospora beticola* isolates to sterol-demethylation-inhibiting fungicides. *Plant Pathology* **49**, 567-572. http://dx.doi.org/10.1046/j.1365-3059.2000.00488.x

Secor GA, Rivera VV, Khan MFR, Gudmestad NC, 2010. Monitoring fungicide sensitivity of *Cercospora beticola* of sugar beet for disease management decisions. *Plant Disease* **94**, 1272-1282. http://dx.doi.org/10.1094/PDIS-07-09-0471

Trueman CL, Hanson LE, Rosenzweig N, Jiang QW, Kirk WW, 2013. First report of QoI insensitive *Cercospora beticola* on sugar beet in Ontario, Canada. *Plant Disease* **97**, 1255. http://dx.doi.org/10.1094/PDIS-03-13-0285-PDN

Trkulja N, Milosavljević A, Stanisavljević R, Mitrović M, Jović J, Toševski I, Bošcović J, 2015. Occurrence of *Cercospora beticola* populations resistant to benzimidazoles and demethylation-inhibiting fungicides in Serbia and their impact on disease management. *Crop Protection* **75**, 80-87. http://dx.doi.org/10.1016/j.cropro.2015.05.017

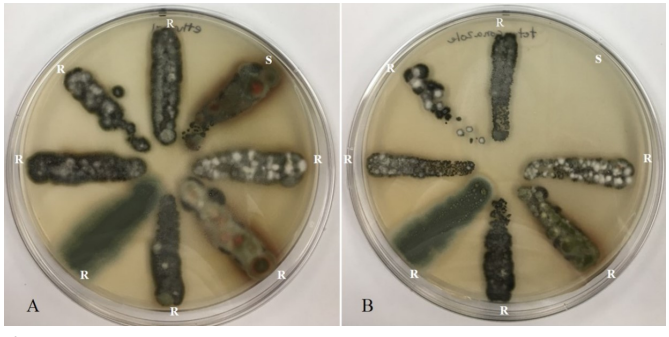

Figure 1

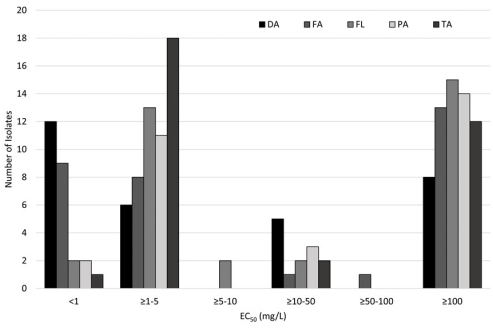

Figure 2

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