



Biocontrol of clubroot on canola – a new initiative

Background Clubroot (Fig. 1), caused by *Plasmodiophora brassicae*, is an important disease of crucifer crops. Since its discovery near Edmonton in 2003, clubroot has spread rapidly in Alberta, and is becoming a serious threat to canola production in Western Canada. The disease produces a range of symptoms (Fig. 2), but early infection on the main root (Fig. 3) has the biggest impact on plant development and yield. Current canola cultivars are highly susceptible [1], and developing cultivars with lasting resistance may prove to be a challenge. Good agronomic practices may reduce disease spread, but their impact is generally insufficient for disease control especially when used alone.



Figure 1 Clubroot on canola from a field in central Alberta.



Figure 2 Early symptoms on lateral (A) and main (B) roots.



Figure 3 Large galls on the main root of young canola plants.

Could soil microorganisms be used for clubroot control? Biocontrol may have potential to reduce clubroot severity, because many biocontrol agents move with the growing crop roots and so could provide season-long protection. Previous studies showed that the fungus *Heteroconium chaetospora* reduced clubroot on Chinese cabbage by up to 97% in small plots [2]. This fungus forms a beneficial symbiosis with roots of Chinese cabbage and induces plant resistance to clubroot and other soil-borne diseases. Our studies have shown that it also reduces clubroot on canola (Table 1). Several commercial biofungicides have also been evaluated on canola, and Serenade®, Prestop® and Mycostop® showed promise for control of clubroot (Fig. 4). Studies to develop practical methods to deliver these agents into canola fields, such as formulations for seed treatment and in-furrow application, are in progress.

Table 1 Efficacy of microbial and chemical fungicides for control of clubroot on canola.

Treatment	Disease severity index ^a	Disease control (%) ^a
Study 1		
Control	41.7 a	0.0
<i>H. chaetospora</i>	11.1 b	73.4
Study 2		
Control	36.5 efg	0.0
Ranman (fungicide)	3.2 abc	91.2
Allegro 500F (fungicide)	3.2 ab	91.2
Serenade®	3.2 ab	91.2
Prestop®	6.9 abc	81.1
Mycostop®	14.3 abcd	60.8

^aMeans with the same letters are not significantly different (LSD, P=0.05)

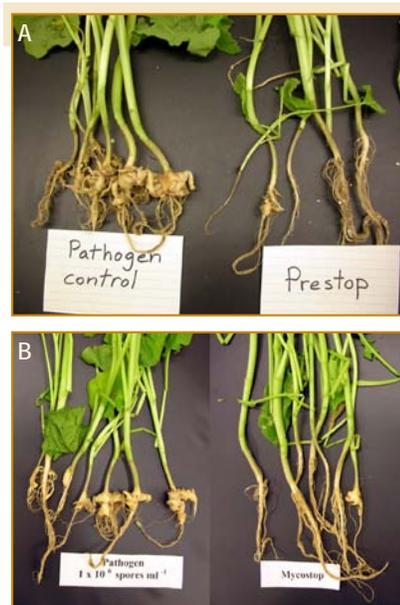


Figure 4 Control of clubroot by the microbial fungicide Prestop® (A) and Mycostop® (B) on canola.

What else is coming down the pipeline? Studies are underway to isolate and screen indigenous soil microorganisms for more effective biocontrol candidates. So far, about 1800 isolates have been obtained from inside or around canola roots, and their potential for clubroot control is being evaluated (Figs. 5 & 6). The goal is to use effective microbial agents in combination with resistant cultivars and good agronomic practices for long-term management of clubroot.

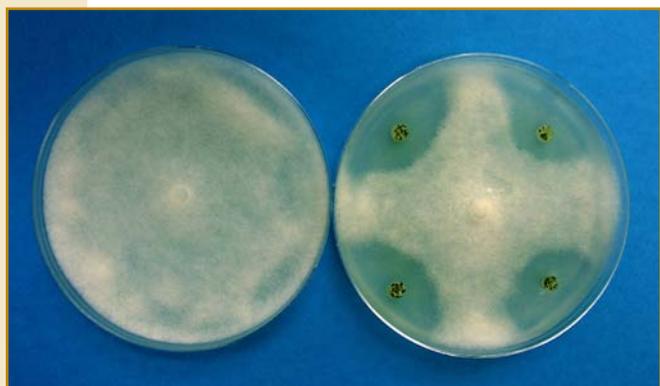


Figure 5 Strong antibiosis (plate on right) against a soil-borne fungal pathogen by a fungus isolated from canola roots.



Figure 6 Rapid screening of biocontrol agents and resistant germplasm using inoculated canola plants in controlled conditions.

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References [1] Strelkov *et al.* 2006. Characterization of *Plasmodiophora brassicae* populations from Alberta, Canada. *Can. J. of Plant Pathol.* 28:467-474. [2] Narisawa *et al.* 2000. Suppression of clubroot and verticillium yellows in Chinese cabbage in the field by the root endophytic fungus, *Heteroconium chaetospora*. *Plant Pathol.* 49:141-146.

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