

**HOST:** Canola (*Brassica napus* L.)  
**PEST:** Clubroot (*Plasmodiophora brassicae* Woronin)

**AUTHORS:** DRURY SC<sup>1</sup>, GOSSEN BD<sup>2</sup>, MCDONALD MR<sup>1</sup>  
<sup>1</sup>University of Guelph, Department of Plant Agriculture, Guelph  
<sup>2</sup>Agriculture and Agri-Food Canada, Saskatoon

**TITLE**            **EVALUATION OF CLUBROOT RESISTANCE IN CANOLA CULTIVARS FOR ONTARIO, 2018**

**OBJECTIVE:** to evaluate the resistance of canola cultivars grown commercially in Ontario to pathotype 2 of *P. brassicae* (Williams' system) at the Muck Crops Research Station, King, ON

**MATERIALS AND METHODS:** A field trial was conducted at the University of Guelph Muck Crops Research Station at a site naturally infested with *P. brassicae* pathotype 2. Canola cultivars from Bayer Crop Science (Bayer), the control canola cultivars ACS N39 (susceptible to *P. brassicae*) and InVigor 5030 (moderately resistant), and the control Shanghai pak choi cultivar Mei Qing Choi (highly susceptible) were assessed. Cultivars L255PC, L2421C, L135C from Bayer are marketed as resistant to clubroot. A randomized complete block design with six replicates was used. The trial was seeded on 14 June at 50 seeds per meter of row. Each experimental unit consisted of one row, 5 m in length, with 40 cm between rows. An Earthway Precision Garden Seeder model 1002-10 was used to seed the trial.

Assessments for clubroot infection on 50 plants per plot took place at 6 weeks after seeding on 25 July. Clubroot symptoms on the roots of each plant were rated on a 0–3 scale and plants were divided into classes where 0 = no clubs, 1 = small clubs on less than 1/3 of roots, 2 = small or intermediate clubs on 1/3 to 2/3 of roots, and 3 = intermediate or large clubs on over 2/3 of roots. Clubroot incidence (CI) was determined as the percentage of plants with clubroot symptoms. Disease severity index (DSI) was calculated using the following formula:

$$DSI = \frac{\Sigma[(\text{class no.})(\text{no. plants in each class})]}{(\text{total no. plants per sample})(\text{no. classes} - 1)} \times 100$$

At harvest, shoot fresh weight was determined from 10 plants per plot. Shoot dry weight of the same plants was determined after 48 hours of oven drying at 60°C. Clubroot incidence, DSI, and fresh and dry shoot weights were analyzed with the Analysis of Variance function for a randomized complete block design of Statistix 10.0. Tukey's test was used for the all-pairwise comparisons.

The canola cultivars evaluated in the field trials were also tested for resistance in a growth room trial. A randomized complete block design with four replicates and 12 plants per experimental unit was used. Plants were seeded in soil-less mix (Sunshine Soil Mix, L4A) in tall narrow pots known as conetainers. The soil-less mix was mixed with fertilizer solution consisting of 0.1% nitrogen, phosphate, potassium (20-20-20), and magnesium sulfate. Two seeds were planted in each pot and thinned to one plant per pot prior to inoculation. To inoculate, 5 ml of  $1 \times 10^7$  resting spores of *P. brassicae* pathotype 2 was applied to the stem base of each plant 6 days after seeding. The plants were watered with tap water adjusted to pH 6.0 with white vinegar. The growth room was set to 24/19°C day/night with 16-hr photoperiod. Clubroot symptoms were assessed on all plants at 6 weeks after inoculation on the 0–3 scale, and clubroot incidence and DSI were determined as described above.

**RESULTS:** Cultivars L255PC, L135C and L2421C had very low incidence and severity of clubroot and were confirmed as resistant (CI = 2–5%, DSI = 1–2). The canola cultivars L252, L233P, ACS N39, InVigor 5030 (CI=99–100% and DSI=95–99) and the Shanghai pak choi cultivar Mei Qing Choi (CI=92% and DSI=83) were susceptible to clubroot. The fresh shoot weight of resistant cultivars was 57% higher than

the susceptible cultivars. Dry weight showed a similar trend, but the differences were not always significant (Table 1).

As in the field trial, CI and DSI in the growth room study were very low (CI and DSI = 0) in the clubroot resistant cultivars. CI and DSI were much higher in the other canola cultivars and Mei Qing Choi (Table 2). It is interesting to note that CI and DSI for Mei Qing Choi were lower than the susceptible canola cultivars in the field, but numerically higher in the growth room trial.

**CONCLUSION:** The cultivars marketed as resistant to clubroot (L255PC, L2421 and L135C) were confirmed to be resistant to pathotype 2 of *P. brassicae* in both the field and growth room trials.

**Table 1.** Clubroot incidence (%) and disease severity index (DSI), and fresh weight and dry weight, of clubroot susceptible and resistant canola cultivars grown at the Muck Crops Research Station, 2018.

Cultivar	Expected reaction	Incidence (%)	DSI (0-100)	Fresh wt. (g plant <sup>-1</sup> )	Dry wt. (mg plant <sup>-1</sup> )
L255PC	Resistant	2 a <sup>1</sup>	1 a	130 a	8857 a
L135C	Resistant	2 a	1 a	108 a	7500 abc
L2421C	Resistant	5 a	2 a	109 a	8332 ab
Mei Qing Choi	Susceptible	92 b	83 b	25	1192
InVigor 5030	Moderately resistant	99 bc	95 c	45 b	4820 c
L252	Susceptible	100 c	99 c	60 b	5760 abc
ACS N39	Susceptible	100 c	98 c	49 b	5633 abc
L233P	Susceptible	100 c	98 c	47 b	5193 bc

<sup>1</sup>Means followed by the same letter in a column are not significantly different at  $P = 0.05$ , Tukey's test.

**Table 2.** Clubroot incidence (%) and disease severity index (DSI) of clubroot susceptible and resistant canola cultivars grown in the growth room study.

Cultivar	Expected reaction	Incidence (%)	DSI (0-100)
L255PC	Resistant	0 b <sup>1</sup>	0 c
L135C	Resistant	0 b	0 c
L2421C	Resistant	0 b	0 c
L252	Susceptible	96 a	85 ab
ACS N39	Susceptible	96 a	83 b
L233P	Susceptible	98 a	92 ab
InVigor 5030	Moderately resistant	100 a	88 ab
Mei Qing Choi	Susceptible	100 a	96 a

<sup>1</sup>Means followed by the same letter in a column are not significantly different at  $P = 0.05$ .

**Funding for this project was provided by the Plant Production Systems of Ontario Agri-Food Innovation Alliance and the Ontario Canola Growers Association.**