Resistance in flax cultivars and genotypes to powdery mildew
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Genetic resistance to powdery mildew is the most economical and sustainable management to reduce the impact of this disease in flax

Introduction
Flax (Linum usitatissimum L.) is a major crop in western Canada with 1-1.5 million ha mostly in Saskatchewan, with smaller acreage in Manitoba and Alberta.

Powdery mildew (PM) caused by the fungus Oidium lini Skoric, was first observed in western Canada in 1997 (Figure 1). The incidence and severity have been on the rise in most flax growing areas on the Canadian Prairie causing an estimated 10-20% yield loss (Figure 2). Canadian flax cultivars are moderately resistant (MR) to PM, a minimum requirement for registering flax cultivars in Canada. The objectives of this study were to identify and characterize new and diverse sources of resistance to improve the level of genetic resistance to PM by pyramiding genes into future cultivars.

Materials and Methods
All commercial flax cultivars, a flax core collection of 500 genotypes plus 167 improved inbred lines from single-plant selections were tested for reaction to PM (O. lin) under natural field inoculum at the Agriculture and Agri-Food Canada, Morden Research and Development Centre from 2012 to 2016. The reaction of the flax genotypes to PM was assessed on the % leaf area affected (LAA) using the scale of 1 to 9: 1 (HR)=<5%, 2 (R)=5-10%, 3 (MR)=11-30%, 4 (MS)=31-40%, 5 (S)=41-50, 6 (S)=51-60, 7 (HS)=61-70, 8 (HS)=71-80, and 9 (HS)=>80% LAA. The area under disease progress curve (AUDPC) was calculated and data was analyzed using SAS. The top 100 flax genotypes with field resistance were tested to the local PM-MOR-1 isolate under controlled growth cabinet conditions.

Results and Discussion
The incidence and severity of PM varied from year to year so did the impact of the disease on the crop. The results from the 4-years field testing showed: <10% resistance in the 500 flax core collection and a few genotypes with moderate resistance (Figure 3), a higher level of resistance 25% in the flax inbred lines (Figure 4), and resistance in 90% of Canadian flax cultivars (Figure 5). The repeated indoor testing to the local PM-MOR-1 isolate showed a high level of resistance in most cultivars and inbred lines, and a high correlation with the field results. Incorporating the genetics from the resistant core collection and inbred selection into future flax cultivars will improve the resistance to PM and reduce the negative impact of this disease on the crop health and yield components.

Conclusions
►PM is prevalent in in western Canada
►PM can cause major epidemics in flax
►<10% resistance in core collection.
►25% resistance in inbred selections.
►90% of Canadian cultivars are either resistant or moderately resistant.
►High correlation between field and indoor testing results.

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