

# Sunflower downy mildew: Pathogen virulence in the United States north-central Great Plains

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## INTRODUCTION

◆ Downy mildew, caused by the biotrophic Oomycete pathogen *Plasmopara halstedii* (Farl.) Berl. and de Toni, is an economically significant seedling disease of cultivated sunflower, *Helianthus annuus* L.

◆ Assessment of pathogen virulence is critical for determining effectiveness of resistance genes.

## OBJECTIVES

◆ Determine virulence of *P. halstedii* isolates in the United States north-central Great Plains.

## MATERIALS AND METHODS

◆ Symptomatic leaves (Figures 1 and 2) were collected from 2014 to 2018 in North Dakota, South Dakota, Minnesota and Nebraska.

◆ Zoospores were increased and pathogen virulence was evaluated on differential lines (Figure 3).

◆ In 2014 and 2015, the standard international set of nine differential lines was screened as well as an expanded set of nine proposed differential lines including five lines from Institut National de la Recherche Agronomique (INRA), France, one line from Nidera S.A., Argentina and three lines from USDA (Figure 4).

◆ In 2016 and 2018, only differential lines containing newer resistance genes were screened (Figure 5).

**Figure 1.** Systemically infected sunflower plant with chlorosis and stunting.



## MATERIALS AND METHODS (Continued)

**Figure 2.** Heavy disease pressure in a field.

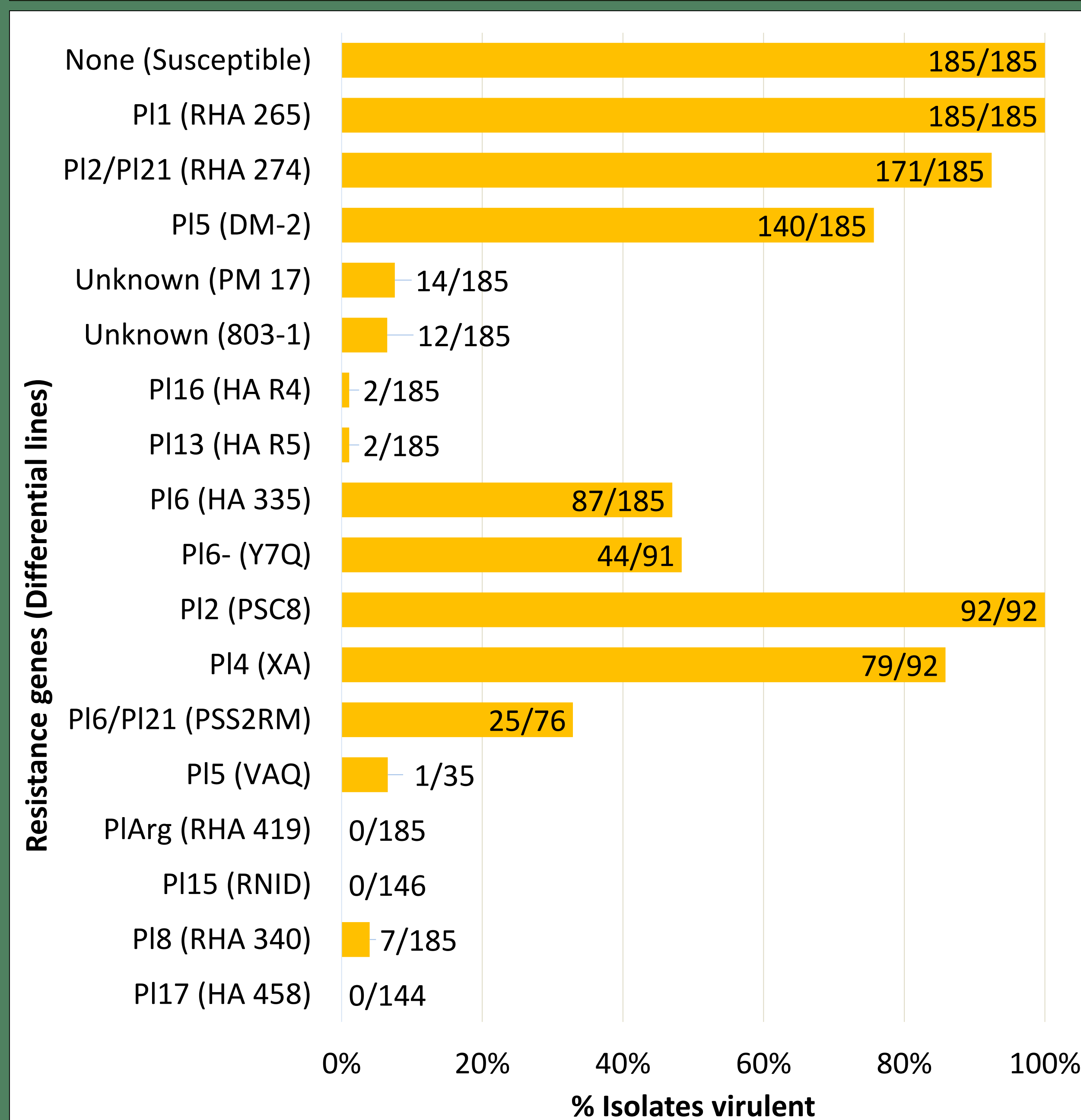


**Figure 3.** Virulent and avirulent reactions on differentials.



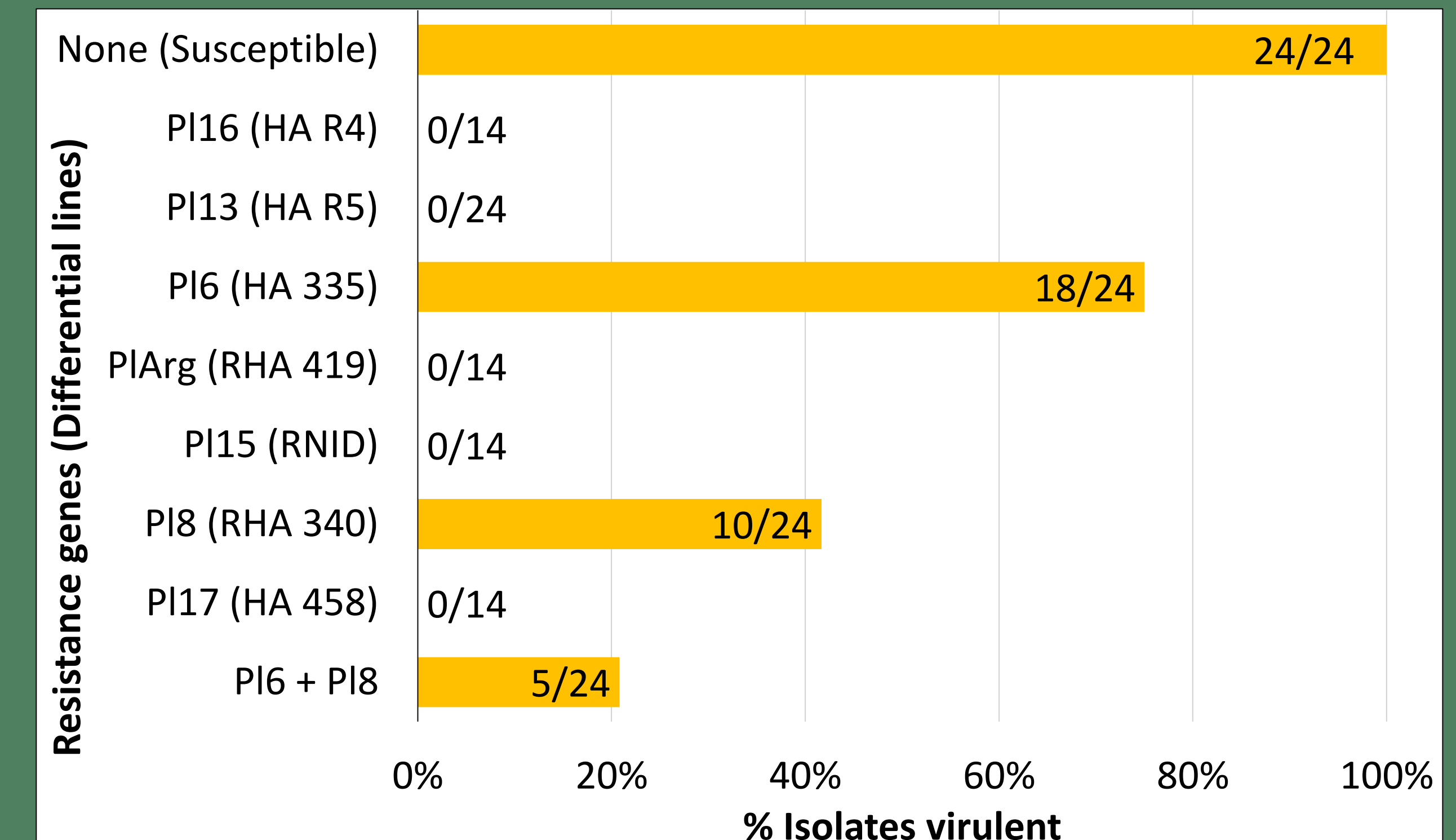
## RESULTS

**Figure 4.** Percentage (n isolates virulent / n isolates screened) of 2014 and 2015 *Plasmopara halstedii* isolates virulent on resistance genes (denoted PI) in 18 differential lines.



## RESULTS (Continued)

**Figure 5.** Percentage (n isolates virulent / n isolates screened) of 2016 and 2018 *Plasmopara halstedii* isolates virulent on resistance genes (denoted PI) in select differential lines.



## CONCLUSIONS

◆ In 2014 and 2015, the first reported virulence was identified on the *PI<sub>8</sub>* resistance gene in seven locations. Virulence was not observed on the *PI<sub>Arg</sub>*, *PI<sub>15</sub>*, and *PI<sub>17</sub>* resistance genes.

◆ In 2016 and 2018, five isolates at three locations with virulence on both the *PI<sub>6</sub>* and *PI<sub>8</sub>* genes were identified, as well as five additional isolates with virulence on the *PI<sub>8</sub>* gene. Virulence was not observed on the *PI<sub>Arg</sub>*, *PI<sub>13</sub>*, *PI<sub>15</sub>*, *PI<sub>16</sub>*, and *PI<sub>17</sub>* resistance genes.

◆ The sunflower industry has at least three resistance genes, *PI<sub>Arg</sub>*, *PI<sub>15</sub>*, and *PI<sub>17</sub>*, which are believed to be completely effective as well as two resistance genes, *PI<sub>13</sub>* and *PI<sub>16</sub>*, for which little virulence has been observed.

## ACKNOWLEDGEMENTS

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