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# Virulence update for downy mildew of sunflowers

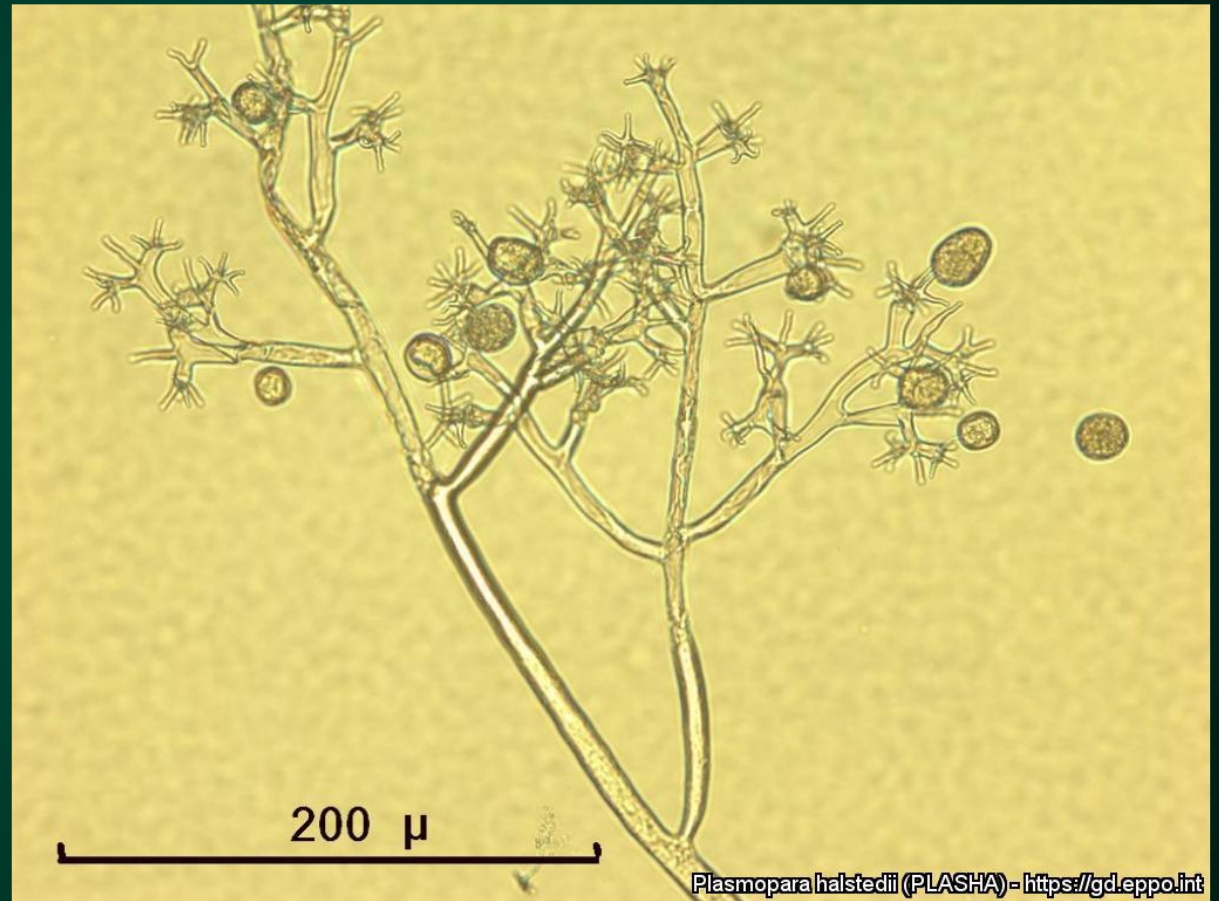
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# Outline

- Introduction to downy mildew
- Genetic resistance
- Virulence update 2014 to 2015
- Virulence update 2016 to 2018
- Conclusions
- We can help you!

# *Plasmopara halstedii*

- Obligato oomycete
- Specific to sunflowers
- Needs water
- Systemic



# Signs and Symptoms of Sunflower Downy Mildew



# Downy Mildew Resistance Genes

- Qualitative resistance
- $Pl_1$  to  $Pl_{21}$  and  $Pl_{Arg}$
- Pathogen under intense selection pressure
- Resistance can be overcome quickly
- Periodic monitoring of pathogen changes remains important for breeding and selecting resistant hybrids

# Objective

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

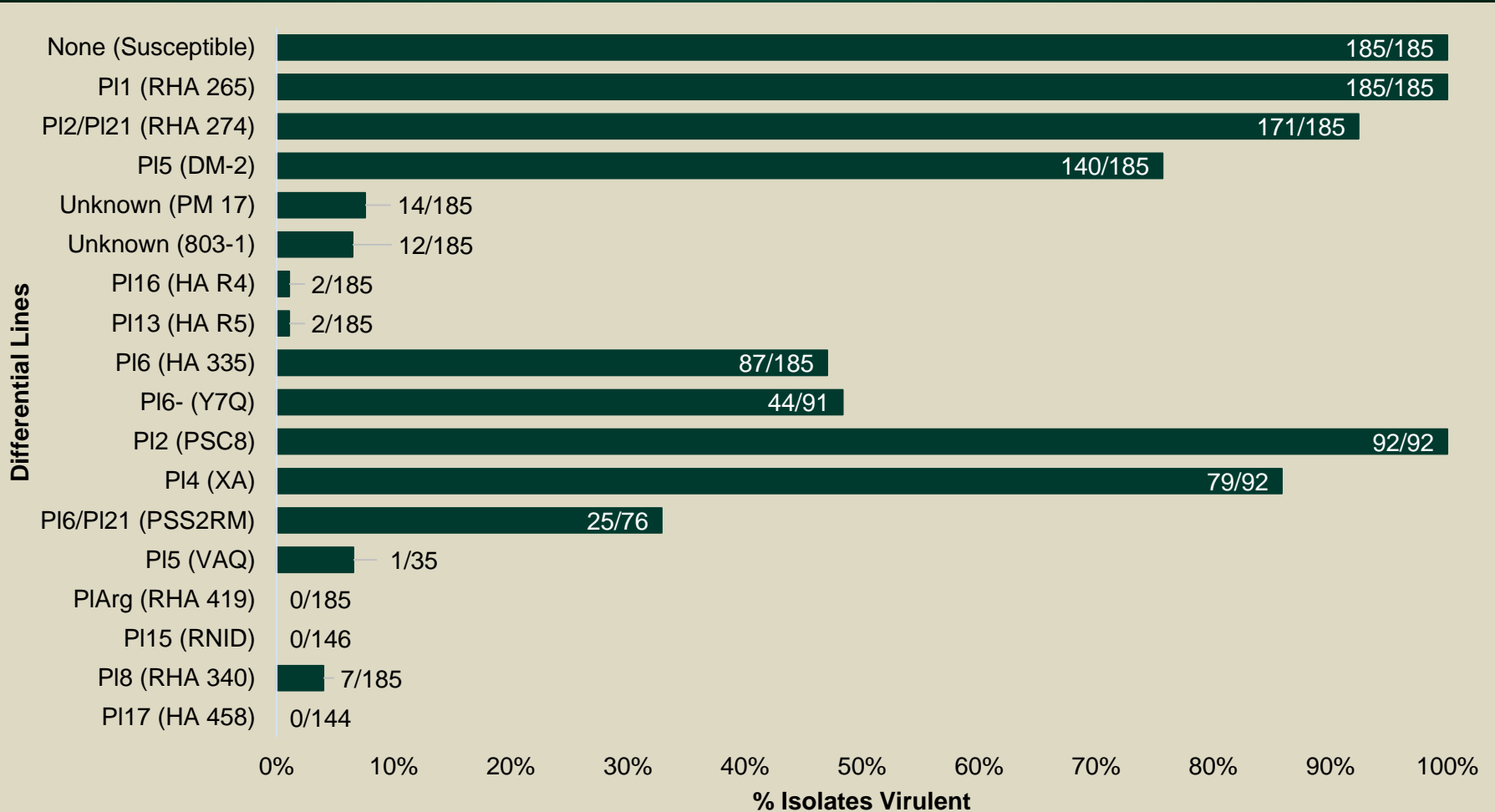
# Downy mildew update: 2014 to 2015



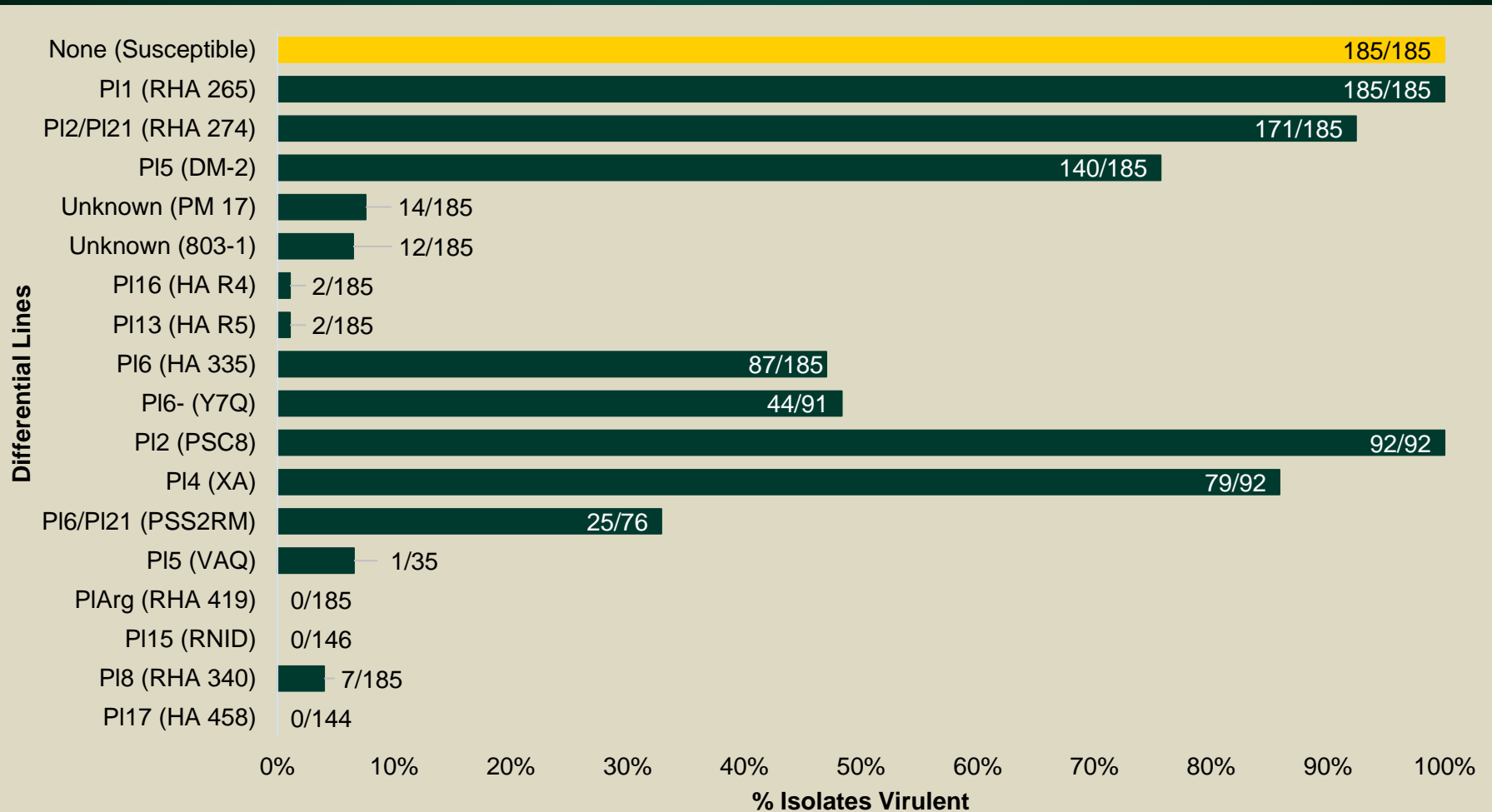
# Materials and Methods

- Symptomatic leaves were collected in North Dakota, South Dakota, Minnesota and Nebraska.
- Zoosporangia were increased and pathogen virulence was evaluated on differential lines.
- 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.

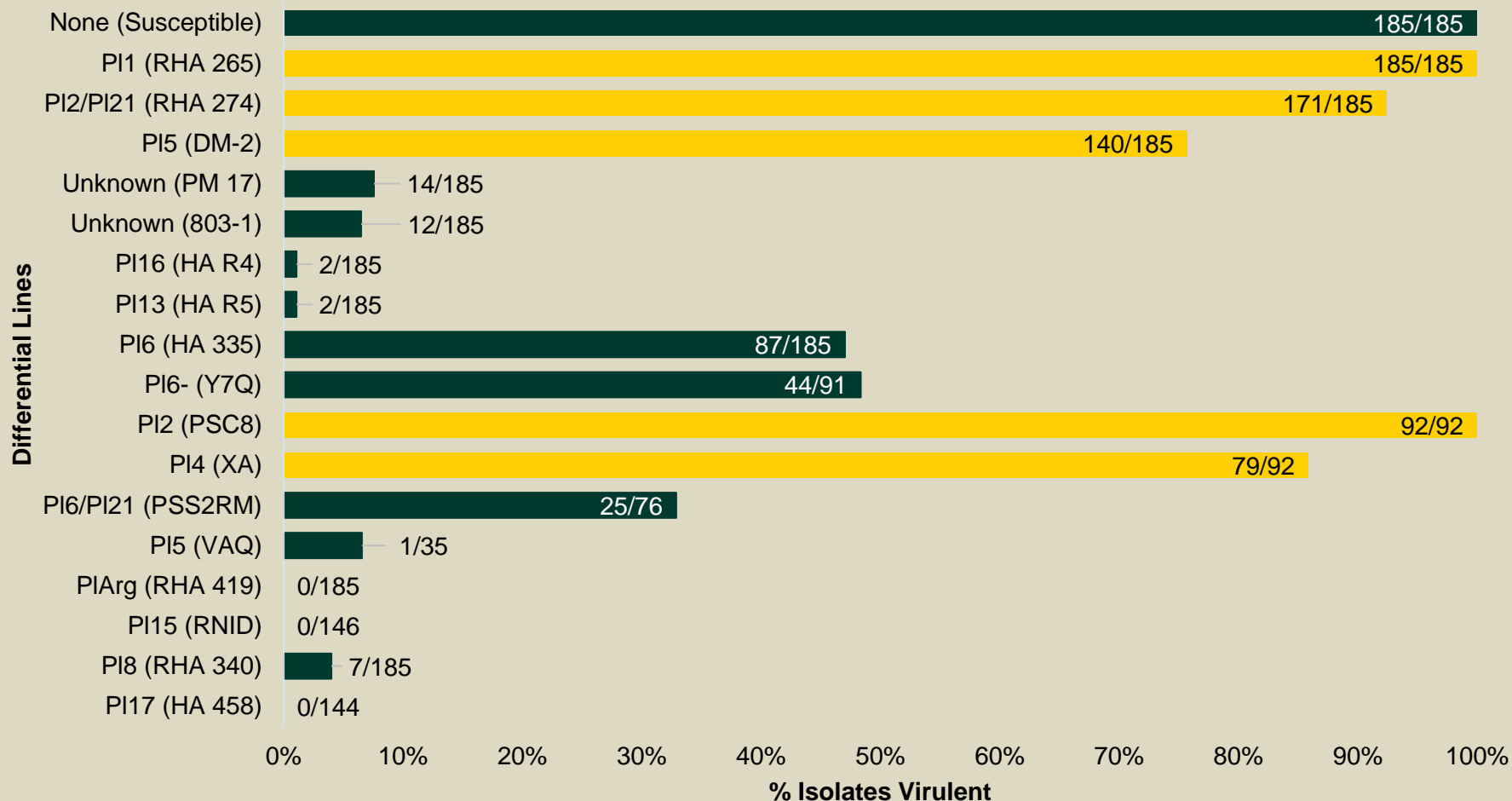
# Percentage of 2014 and 2015 downy mildew isolates virulent on differentials



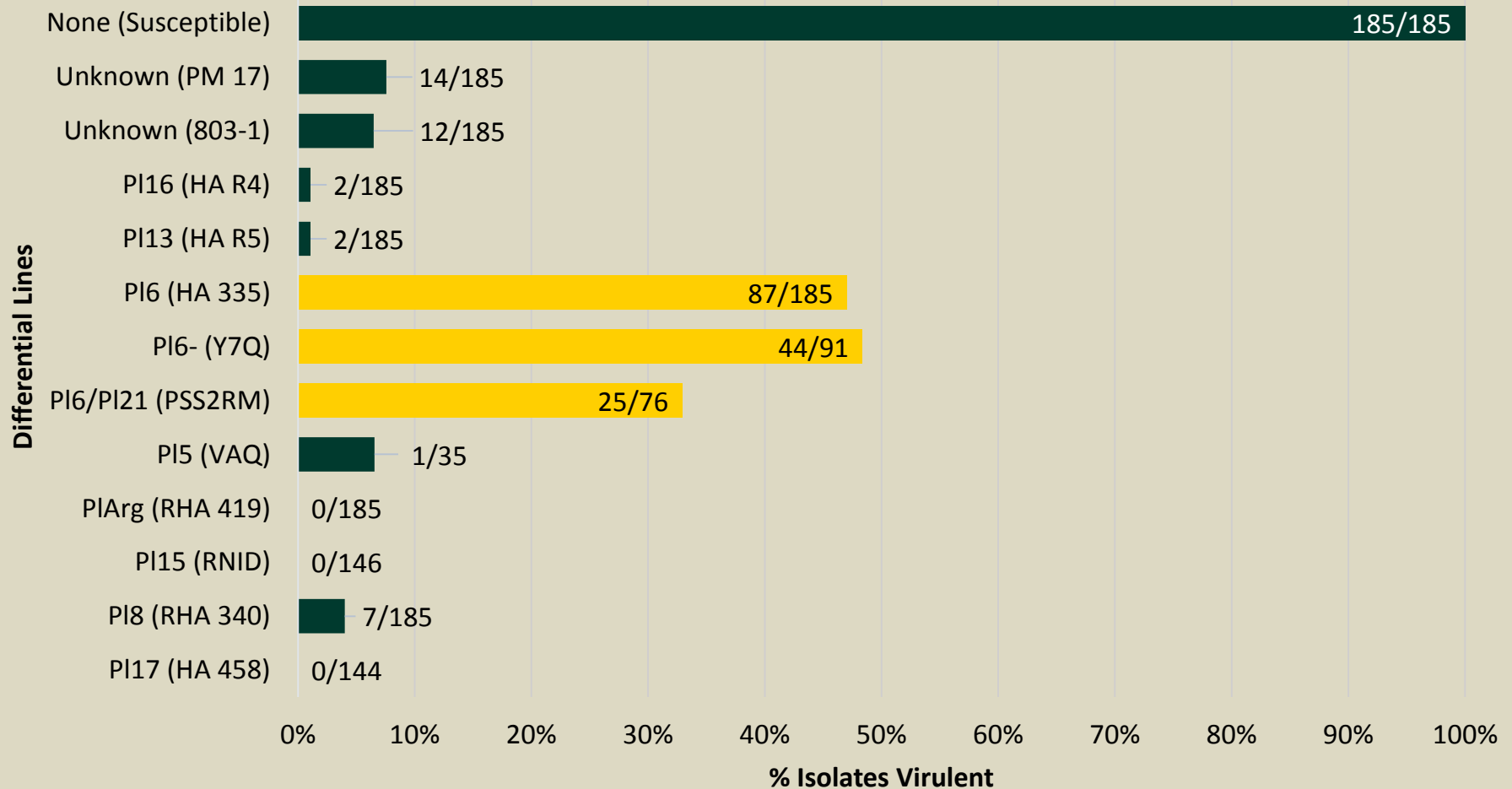
# Percentage of 2014 and 2015 downy mildew isolates virulent on differentials



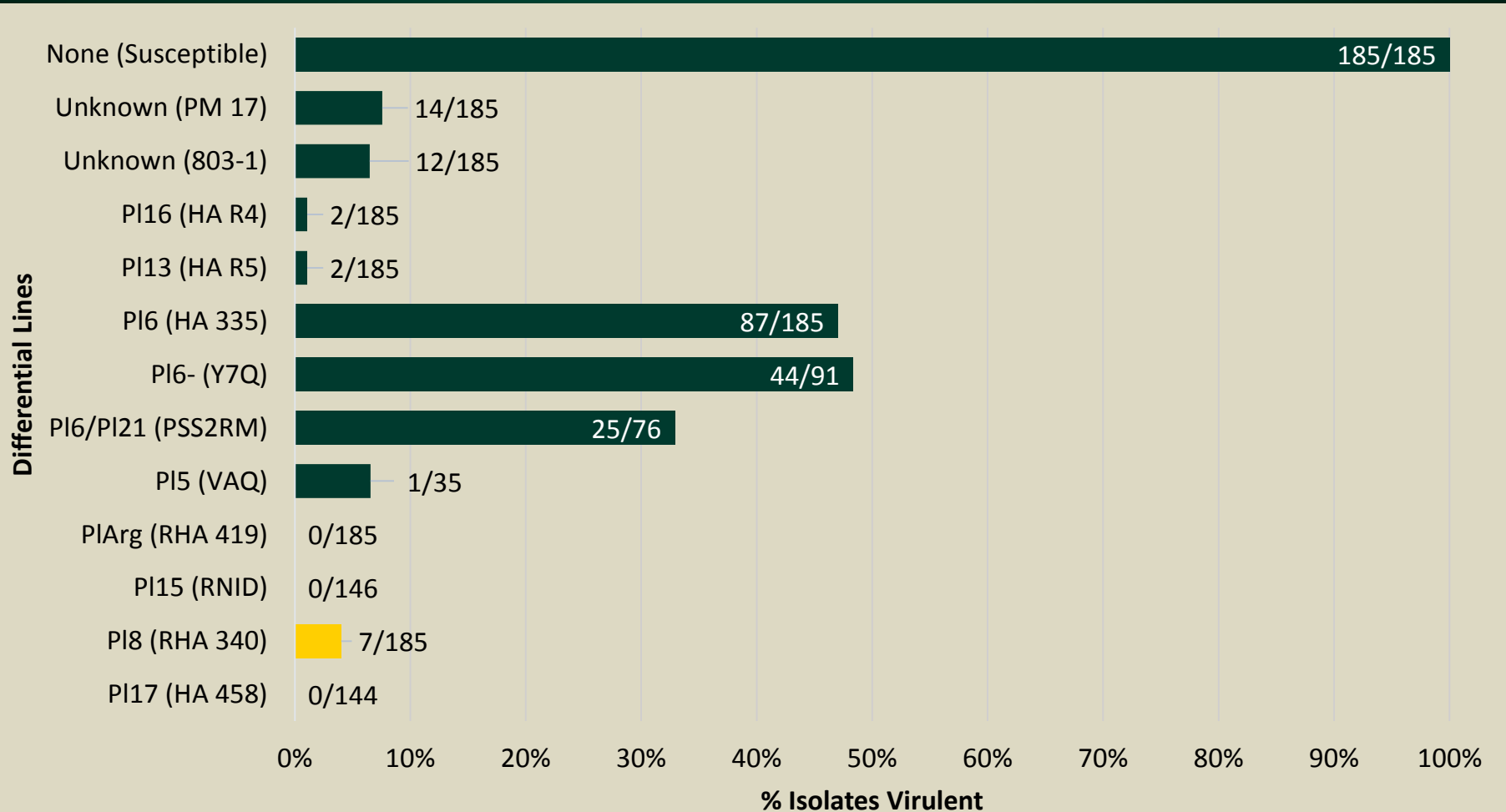
# Percentage of 2014 and 2015 downy mildew isolates virulent on differentials



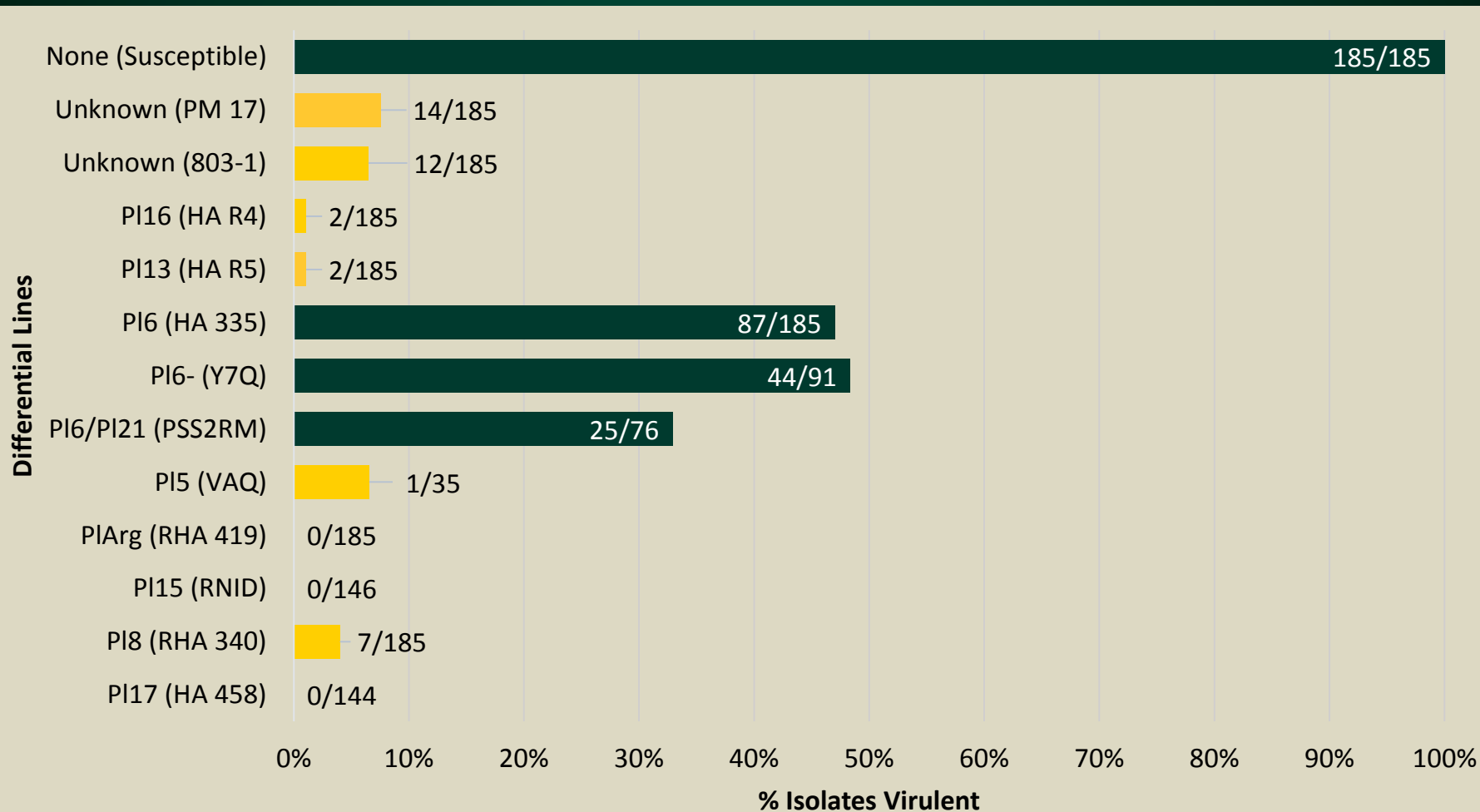
# Percentage of 2014 and 2015 downy mildew isolates virulent on differential lines containing $PI_6$ resistance gene



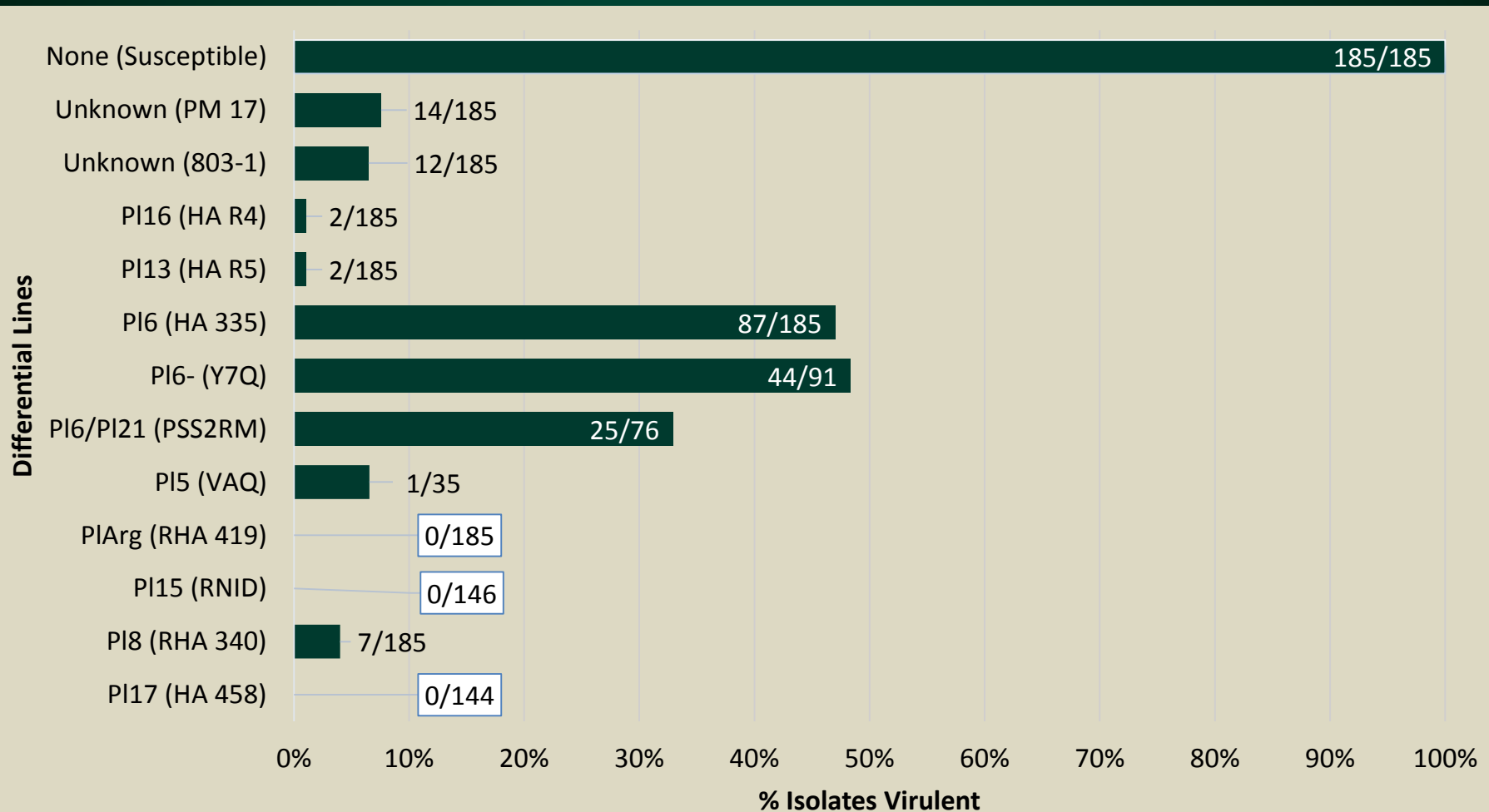
# Percentage of 2014 and 2015 downy mildew isolates virulent on differential lines containing *Pl<sub>8</sub>* resistance gene



# Percentage of 2014 and 2015 downy mildew isolates virulent on differential lines containing effective resistance genes



# Percentage of 2014 and 2015 downy mildew isolates virulent on differential lines containing very effective resistance genes





# Downy mildew update: 2016 to 2018

2016



Susceptible

$PI_6$

$PI_8$

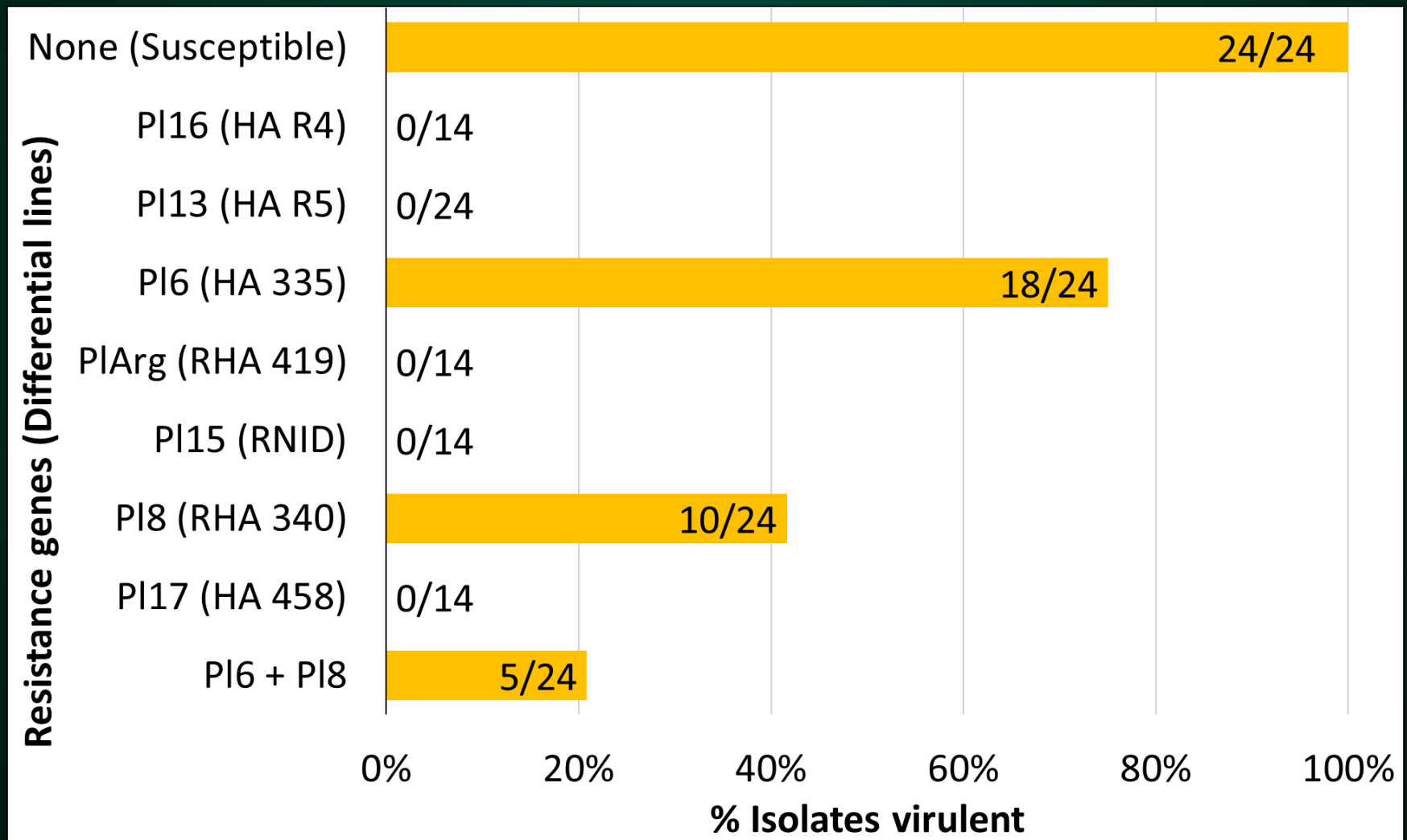
$PI_{15}$

Susceptible

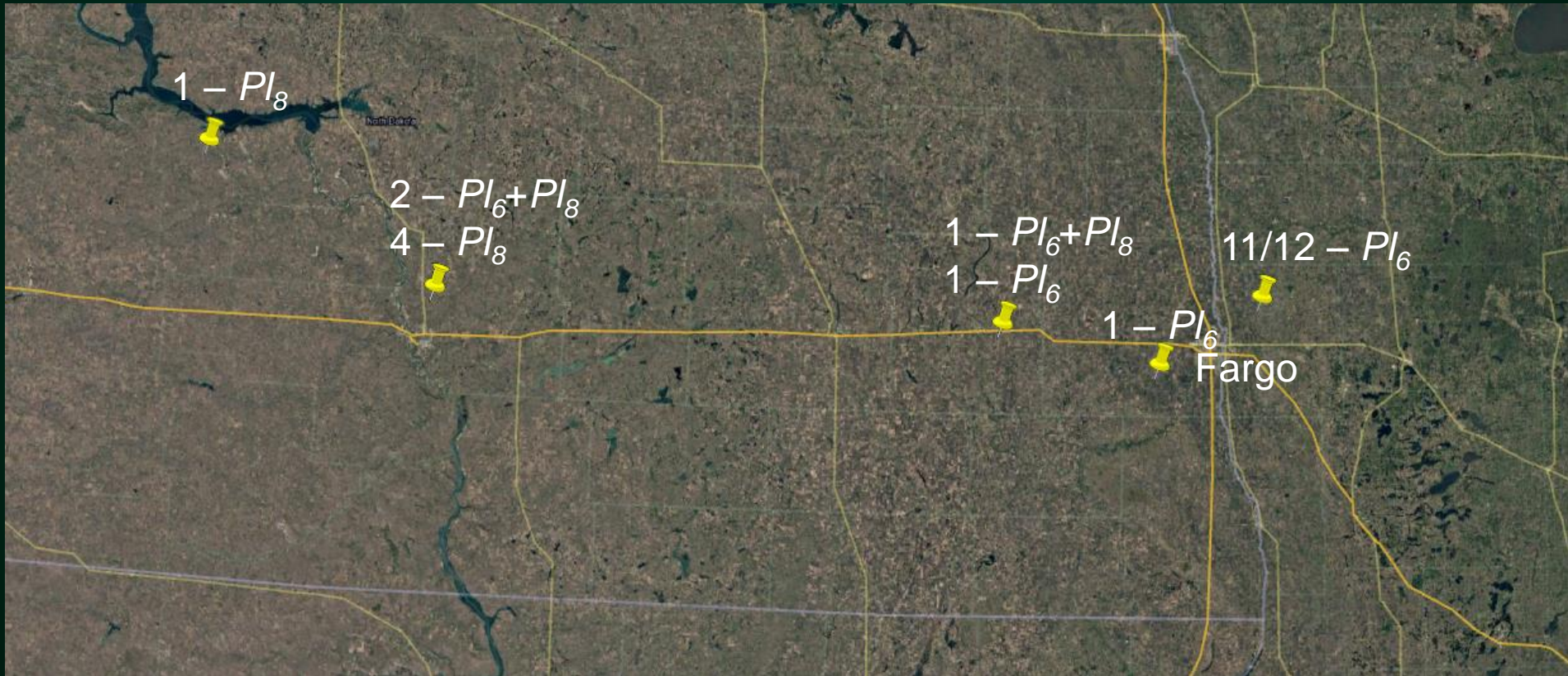
# Materials and Methods

- Symptomatic leaves were collected from North Dakota and Minnesota.
- Zoosporangia were increased and pathogen virulence was evaluated on differential lines.
- Only differential lines containing newer resistance genes were screened.

# Percentage of 2016 and 2018 downy mildew isolates virulent on select differentials



# 2018 Downy mildew isolates



(Google Earth Pro)

# Conclusions

- In 2014 and 2015, the first reported virulence was identified on the  $PI_8$  resistance gene in seven locations. Virulence was not observed on the  $PI_{Arg}$ ,  $PI_{15}$ , and  $PI_{17}$  resistance genes.
- In 2016 and 2018, five isolates at three locations with virulence on both the  $PI_6$  and  $PI_8$  genes were identified, as well as five additional isolates with virulence on the  $PI_8$  gene. Virulence was not observed on the  $PI_{Arg}$ ,  $PI_{13}$ ,  $PI_{15}$ ,  $PI_{16}$ , and  $PI_{17}$  resistance genes.
- The sunflower industry has at least three resistance genes,  $PI_{Arg}$ ,  $PI_{15}$ , and  $PI_{17}$ , which are believed to be completely effective as well as two resistance genes,  $PI_{13}$  and  $PI_{16}$ , for which little virulence has been observed.

# Acknowledgements

- **Pioneer**
- **National Sunflower Association**
- **ND Agriculture Experiment Station**
- **NDSU Extension Service**
- **NDSU Extension Plant Pathology Group**
- **USDA ARS - Sunflower and Plant Biology Unit**

# We Can Help You!