

Prevalence and Virulence of *Plasmopara halstedii* (Downy Mildew) in Sunflowers in 2014

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Objective

Determine prevalence and assess virulence of *Plasmopara halstedii* (downy mildew) in sunflowers.

Materials and Methods

Incidence was calculated from 40 plants in five locations in each field surveyed in North Dakota, South Dakota and Minnesota for a total of 200 plants. Sunflower leaves and/or plants displaying downy mildew symptoms (Figures 1 and 2) were collected. Susceptible sunflower seedlings were inoculated with a spore solution to increase *P. halstedii* inoculum. Cotyledons were desiccated and frozen at -80. After revival from the freezer on additional susceptible seedlings, fresh spores were inoculated onto a standard set of nine differential lines to determine physiological race as well as thirteen supplemental differential lines to determine virulence on additional genes.

Results and Discussion

A total of 105 sunflower fields were surveyed for *P. halstedii* incidence in 2014 (Figure 3). Approximately 2/3 of the fields (68 of 105) had downy mildew, and in the majority of the fields the incidence of infected plants was low. A higher incidence of downy mildew was recorded throughout the sampling area, and severely infected fields did not appear to be concentrated in any one region. Only 10 of the fields surveyed had incidence of 5% or greater.

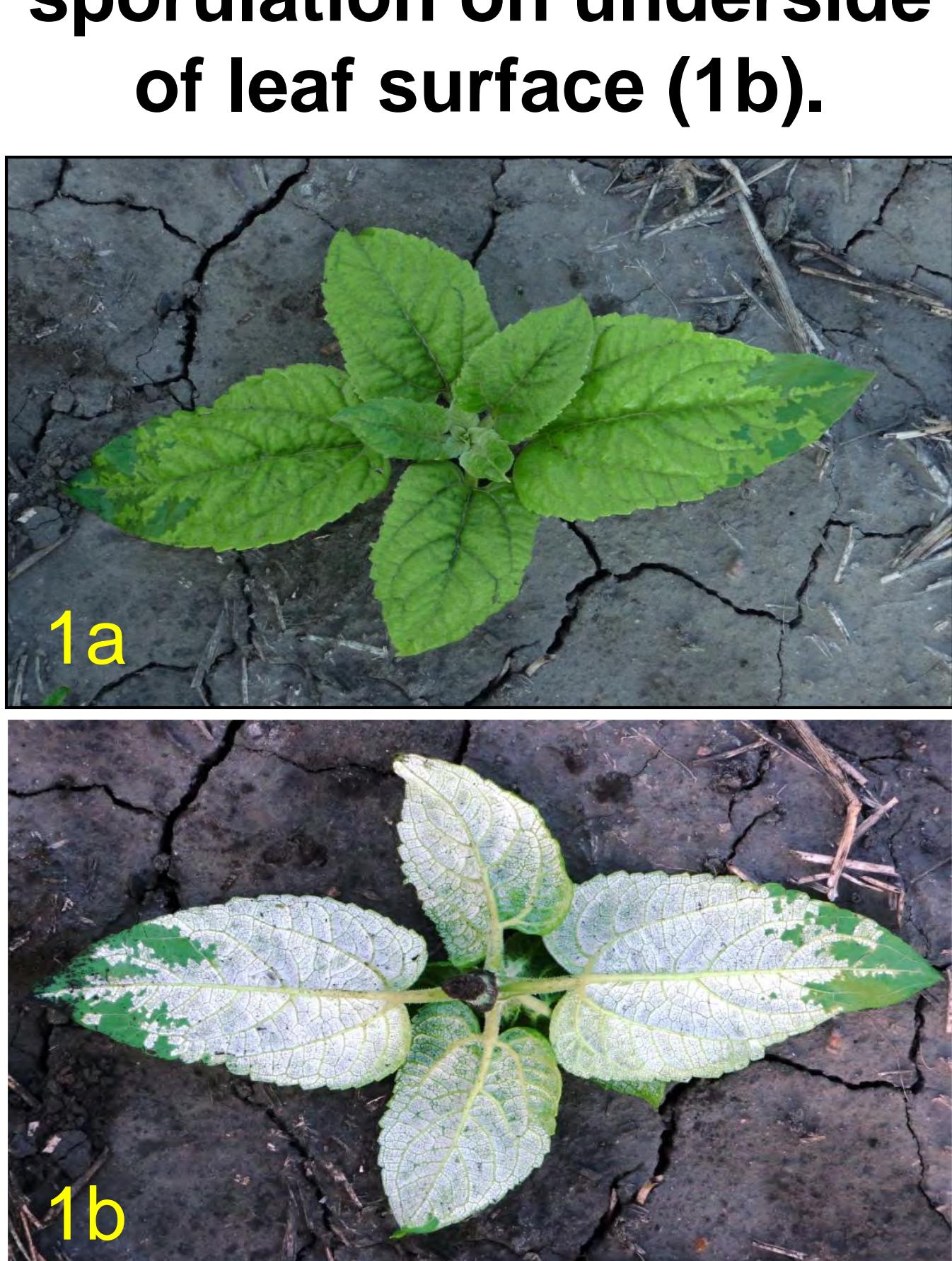
Sunflower leaves and/or plants displaying downy mildew symptoms were collected or received from 81 plots or fields in North Dakota, South Dakota and Minnesota. Of the 220 total samples, 105 were race typed using the standard nine differential lines. Races 714, 710 and 700 were most common and races 304 and 707 were found for the first time in the United States (Table 1). No virulence was found on six supplemental lines containing *Pl*_{Arg}, *Pl*₁₇, *Pl*₁₈, *Pl*₁₅ and several unknown genes (Table 2).

Future Work

The ability to characterize *P. halstedii* virulence has outgrown the current nine, internationally used differential lines. The use of other USDA, INRA and NIDERA lines is being explored to help characterize the new races and to standardize the *P. halstedii* race typing globally. To confirm virulence to *Pl*₈, the two samples virulent on RHA 340 will be evaluated on additional lines containing the same gene.

Acknowledgements

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Figures 1a and 1b.
Chlorosis on upper leaf surface (1a) and abundant white sporulation on underside of leaf surface (1b).



Figure 2. Stunting of downy mildew infected sunflower plants (in yellow oval) as compared to healthy plants.

Figure 3. 105 Fields Surveyed in North and South Dakota

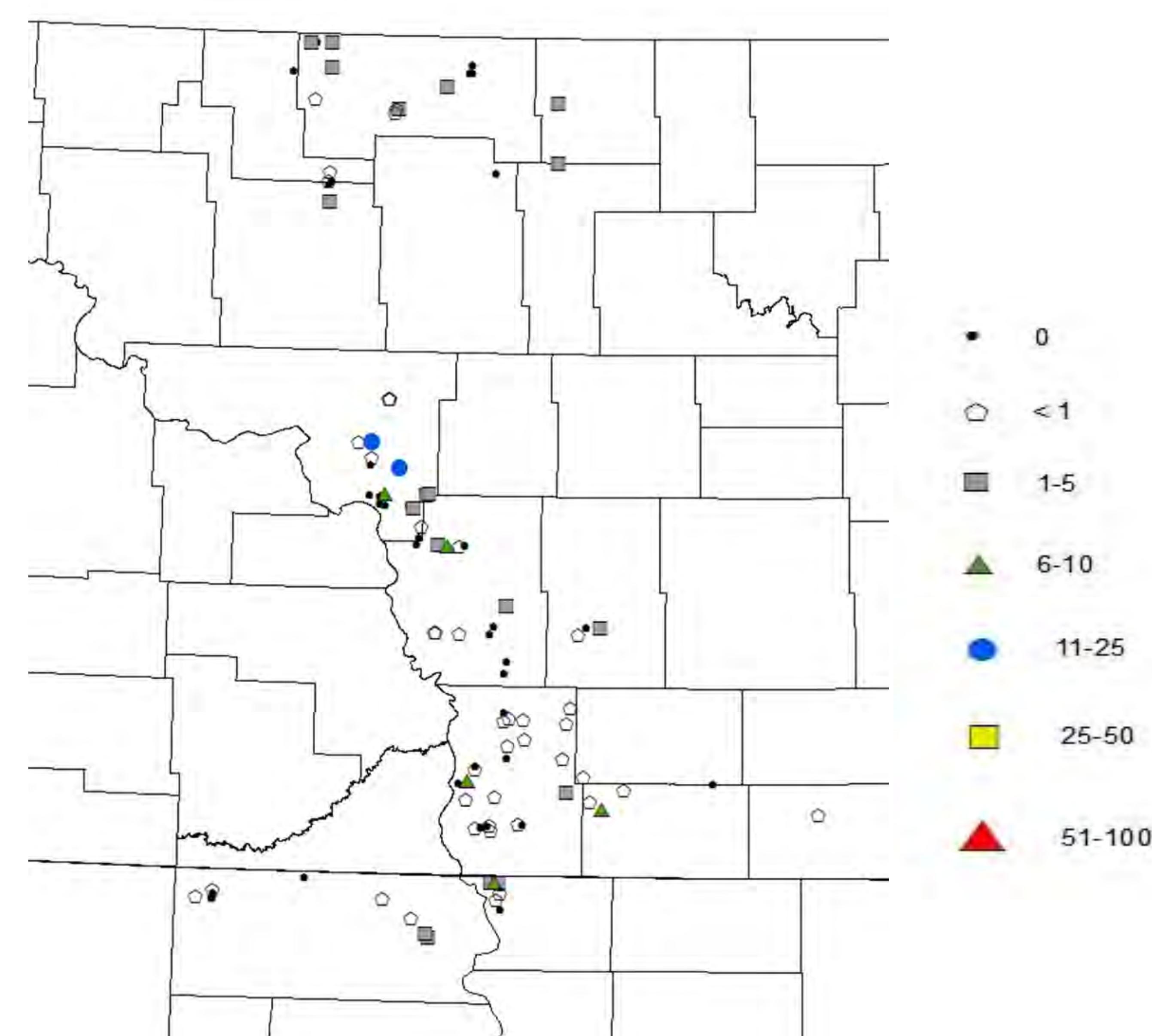


Table 1. 2014 Races Using Standard Differentials

Race	304	314	700	710	704	714	734	774	707
Quantity	1	3	19	33	1	37	1	9	1

Table 2.
Results for Standard and Supplemental Differential Lines

Sunflower Lines	Origin	Postulated <i>Pl</i> R genes	Isolates Virulent / Isolates Screened
Susceptible (MYC 270)		None	105/105
RHA 265	USDA	<i>Pl</i> ₁	105/105
RHA 274	USDA	<i>Pl</i> ₂ / <i>Pl</i> ₂₁	101/105
DM-2	USDA	?	83/105
PM 17	USDA	?	10/105
803	IFVC	?	9/105
HA-R4	USDA	<i>Pl</i> ₁₆	1/105
HA-R5	USDA	<i>Pl</i> ₁₃	1/105
HA 335	USDA	<i>Pl</i> ₆	53/105
RHA 340	USDA	<i>Pl</i> ₈	2/105
RHA 419	USDA	<i>Pl</i> _{Arg}	0/105
HA 458	USDA	<i>Pl</i> ₁₇	0/61
HA-DM1*	USDA	<i>Pl</i> ₁₈	0/87
TX 16R**	USDA	?	0/84
RHA 468	USDA	?	0/66
RHA 428**	USDA	?	15/66
RNID	NIDERA	<i>Pl</i> ₁₅	0/66
Y7Q	INRA	<i>Pl</i> ₆₋	26/63
PSC8	INRA	<i>Pl</i> ₂	65/65
XA	INRA	<i>Pl</i> ₄	61/65
PSS2RM	INRA	<i>Pl</i> ₆ / <i>Pl</i> ₂₁	18/47
VAQ	INRA	<i>Pl</i> ₅	1/30

*Not released

**Seed purity being evaluated