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 PI_{Arg}, PI_{17}, PI_{18}, PI_{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 PI_8, the two samples virulent on RHA 340 will be evaluated on additional lines containing the same gene.

Acknowledgements

Dr. Hulke and Dr. Qi at USDA-ARS, Fargo, ND. Thank you to all the Extension personnel and seed company personnel who collected and sent us downy mildew samples.

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

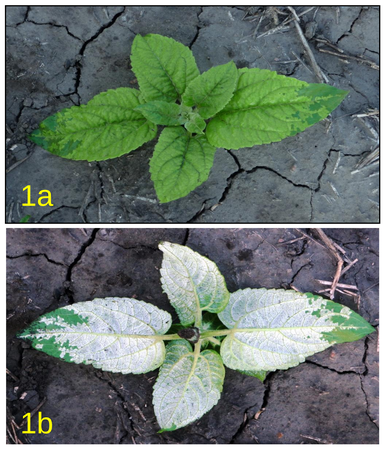

Figure 2. Stunting of downy mildew infected sunflower plants (in yellow oval) as compared to healthy plants.

Figure 3. 105 Fields Surveyed in North and South Dakota

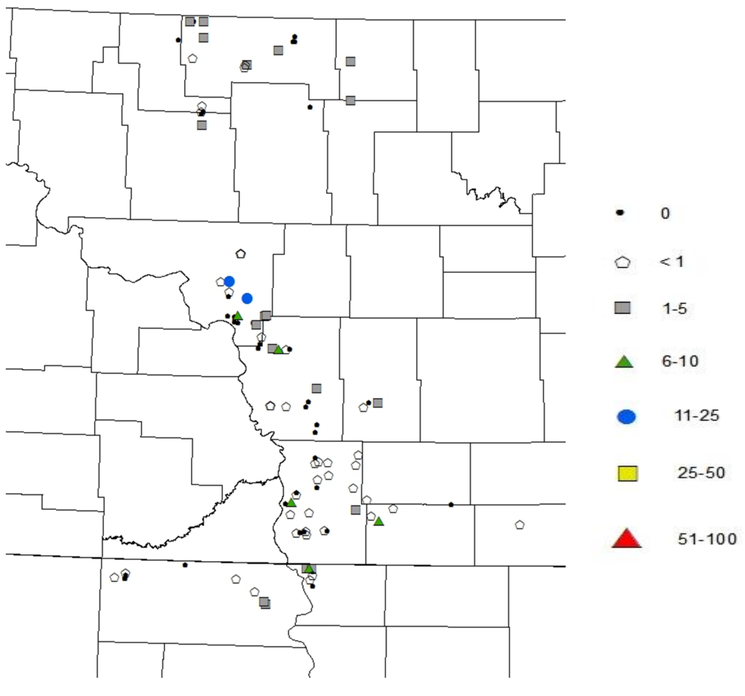

Table 1. 2014 Races Using Standard Differentials

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 *PI* R genes	Isolates Virulent / Isolates Screened
Standard	Susceptible (MYC 270)		None	105/105
	RHA 265	USDA	PI_1	105/105
	RHA 274	USDA	PI_2/PI_{21}	101/105
	DM-2	USDA	*?*	83/105
	PM 17	USDA	*?*	10/105
	803	IFVC	*?*	9/105
	HA-R4	USDA	PI_{16}	1/105
	HA-R5	USDA	PI_{13}	1/105
	HA 335	USDA	PI_6	53/105
Supplemental	RHA 340	USDA	PI_8	2/105
	RHA 419	USDA	PI_{Arg}	0/105
	HA 458	USDA	PI_{17}	0/61
	HA-DM1*	USDA	PI_{18}	0/87
	TX 16R**	USDA	*?*	0/84
	RHA 468	USDA	*?*	0/66
	RHA 428**	USDA	*?*	15/66
	RNID	NIDERA	PI_{15}	0/66
	Y7Q	INRA	PI_{6-}	26/63
	PSC8	INRA	PI_2	65/65
	XA	INRA	PI_4	61/65
	PSS2RM	INRA	PI_6/PI_{21}	18/47
	VAQ	INRA	PI_5	1/30

*Not released

**Seed purity being evaluated