

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

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Objectives

1. Monitor race changes and effectiveness of resistance genes
2. Determine prevalence and incidence of downy mildew in North Dakota and South Dakota

Outline

- Introduction
- Downy mildew races
- Virulence on additional genes
- Prevalence and incidence of downy mildew
- Conclusions

Plasmopara halstedii

- Obligate oomycete
- Specific to sunflowers
- Needs water
- Systemic
- Sporulates



Importance of Downy Mildew

Yield loss

- Most infected plants die
- Survivors yield zero – and compete
- Rarely are fields uniformly infected



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Materials and Methods

- Collected 436 samples from 185 fields
- USDA-ARS, extension and seed company personnel sent in an additional 126 samples from North Dakota, South Dakota, Minnesota and Nebraska



Materials and Methods



Infected Sunflowers



Sporulated Sunflowers



Standard Differentials

Differential Number	Postulated PI R genes	Sunflower Line	Isolates Virulent / Isolates Screened	Percent Isolates Virulent
1	None	Susceptible (MYC 270)	185/185	100
2	PI_1	RHA 265	185/185	100
3	PI_2/PI_{21}	RHA 274	171/185	92
4	PI_5	DM-2	139/185	75
5	?	PM 17	15/185	8
6	?	803	12/185	6
7	PI_{16}	HA-R4	2/185	1
8	PI_{13}	HA-R5	2/185	1
9	PI_6	HA 335	87/185	47

Standard Differentials

1st Digit

2nd Digit

3rd Digit

1

2

4

1

2

4

1

2

4

Supplemental Differentials



Standard Differentials

1st Digit

2nd Digit

3rd Digit

714 = 1 2 4 1 0 0 0 0 4 Supplemental Differentials



Susc RHA 265 RHA 274 DM-2 PM 17 803 HA-R4 HA-R5 HA 335

Downy Mildew Races

Race	2014	2015	Total
304*	1	0	1
314	3	10	13
700	19	19	38
704	1	4	5
707*	1	0	1
710	33	25	58
714	38	17	55
717*	0	1	1
730	0	1	1
770	0	1	1
774	9	2	11

Supplemental Lines

Postulated PI R genes	Sunflower Lines	Isolates Virulent / Isolates Screened	Percent Isolates Virulent
<i>Pl₈</i>	RHA 340	7/185	4
<i>Pl_{Arg}</i>	RHA 419	0/185	0
<i>Pl₁₅</i>	RNID	0/146	0
<i>Pl₁₇</i>	HA 458	0/141	0
<i>Pl₁₈</i>	HA DM 1	0/167	0
?	RHA 468	0/146	0
?	TX 16R*	0/164	0
?	RHA 428*	15/66	23

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Materials and Methods

- Timing – early in the growing season
- 181 fields
- Prevalence is + or –
- Incidence = 40 plants in 2-row pairs at 5 points along a W for a total of 200 plants

Prevalence and Incidence in North Dakota and South Dakota

	2014	2015
Prevalence	65% (68/105)	78% (59/76)
Incidence*		
0	65%	55%
0.5 – 4.5%	25%	24%
5 – 14.5%	9%	14%
≥ 15%	1%	7%

Conclusions

- *P. halstedii* has a proven history of overcoming resistance genes
- Use of resistant hybrids in combination with fungicide seed treatments is still the best management plan

Acknowledgements

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

References

- Friskop, A., Markell, S. and Gulya, T. 2009. Downy Mildew of Sunflower. NDSU Extension Service, N.D. Agricultural Experiment Station, Fargo, ND PP-1402.
- Gascuel, Q., Martinez, Y., Boniface, M.-C., Vear, F., Pichon, M. and Godiard, L. 2015. The sunflower downy mildew pathogen *Plasmopara halstedii*. *Molecular Plant Pathology*, 16: 109–122. doi: 10.1111/mpp.12164
- Gulya, T., Kandel, H., McMullen, M., Knodel, J., Berglund, D., Mathew, F., Lamey, H. A., Nowatski, J., and Markell, S. 2013. Prevalence and incidence of sunflower downy mildew in North Dakota between 2001 and 2011. Online. *Plant Health Progress*. doi:10.1094/PHP-2013-0522-01-RS.
- Gulya, T., Rashid, K.Y., and Masirevic, S.M. 1997. Sunflower Diseases. In: Schneiter AA (ed) *Sunflower technology and production*. American Society Agronomy, Madison, Wisconsin.

Questions?