



Updates on Sunflower Rust and Downy Mildew Races in Manitoba



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Sunflower rust severity

Mid-season

Late-season

>50% LAI



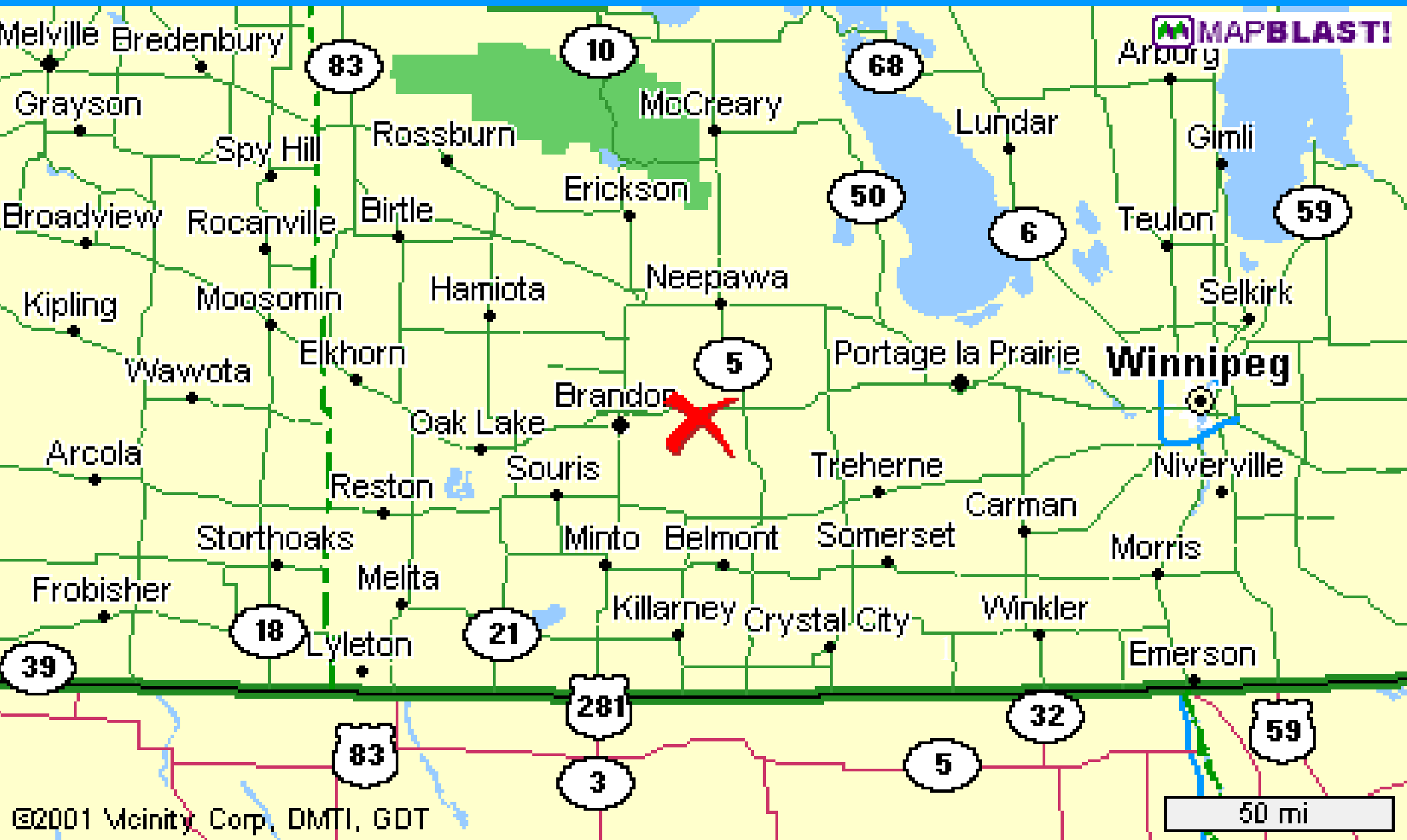
Prevalence and Severity of Rust

Year	Infested Fields % of Total	Mean Disease % LAI	Range %LAI	Prevalent Races
2007	57	10	T- 50	300 (3) & 700 (4)
2006	66	6	T- 40	300 & 700
2005	27	8	T- 30	300 , 700
2004	60	8	T- 30	300, 100, 700
2003	65	25	T- 80	300 , 700
2002	50	15	T- 80	Na
2001	27	8	T- 20	Na
2000	40	15	T- 60	Na
1999	60	5	T- 20	Na

Materials & Methods

- **Continuous study**
- **Collect samples of rust from infected sunflower fields**
- **Bulk samples, Increase small samples indoor.**
- **Test each sample on a set of 9 sunflower rust differential lines.**
 - **Controlled growth room conditions, 16hrs day.**
 - **Inoculate at 2-wk old seedling.**
 - **Incubate for 20 hrs at High RH, 20°C.**
 - **Assess for Infection Type & Severity after 12 days.**
- **Determine levels of susceptibility and resistance**
- **Determine Race identity of each rust sample collected.**

Area Surveyed in Southern Manitoba



Rust Races and Prevalence, 2004

Sunflower Differential Lines	Rust Races, Prevalence, and Virulence							
	106 5%	126 15%	306 5%	320 5%	326 55%	336 5%	726 10%	727 5%
S-37-388	S	S	S	S	S	S	S	S
CM-90RR	R	R	S	S	S	S	S	S
MC-29-3	R	R	R	R	R	R	S	S
P-386	R	R	R	R	R	S	R	S
HA-R1	R	S	R	S	S	S	S	S
HA-R2	R	R	R	R	R	R	R	S
HA-R3	R	R	R	R	R	R	R	R
HA-R4	S	S	S	R	S	S	S	S
HA-R5	S	S	S	R	S	S	S	S

Rust Races and Prevalence, 2005

Sunflower Differential Lines	Rust Races, Prevalence, and Virulence						
	326 61%	336 18%	337 4%	376 4%	726 4%	776 4%	777 4%
S-37-388	S	S	S	S	S	S	S
CM-90RR	S	S	S	S	S	S	S
MC-29-3	R	R	R	R	S	S	S
P-386	R	S	S	S	R	S	S
HA-R1	S	S	S	S	S	S	S
HA-R2	R	R	R	S	R	S	S
HA-R3	R	R	S	R	R	R	S
HA-R4	S	S	S	S	S	S	S
HA-R5	S	S	S	S	S	S	S

Rust Races and Prevalence, 2006

Sunflower Differential Lines	Rust Races, Prevalence, and Virulence								
	520 4%	320 4%	324 40%	326 4%	334 12%	336 12%	337 4%	365 8%	734 12%
S-37-388	S	S	S	S	S	S	S	S	S
CM-90RR	R	S	S	S	S	S	S	S	S
MC-29-3	S	R	R	R	R	R	R	R	S
P-386	R	R	R	R	S	S	S	R	S
HA-R1	S	S	S	S	S	S	S	S	S
HA-R2	R	R	R	R	R	R	R	S	R
HA-R3	R	R	R	R	R	R	S	S	R
HA-R4	R	R	R	S	R	S	S	R	R
HA-R5	R	R	S	S	S	S	S	S	S

Prevalent Rust Races 2004-07

Year	Race 100 (1)	Race 300 (3)	Race 500 (2)	Race 700 (4)
2004	20%	65%	0	15%
Prevalent Races	126	326	-	726
<hr/>				
2005	0	87%	0	13%
Prevalent Races	-	326	-	726
<hr/>				
2006	0	84%	4%	12%
Prevalent Races	-	324	520	734
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2007	0	88%	4	8%
Prevalent Races	-	326	536	736

Conclusions

- Major shift in sunflower rust races
- Low frequency of Race 100 (original race 1)
- Low frequency of Race 500 (original race 2)
- High frequency of race group 300 (original race 3)
- Moderate frequency of race group 700 (old Race 4)
- Most commercial sunflower hybrids lack resistance to New Races.

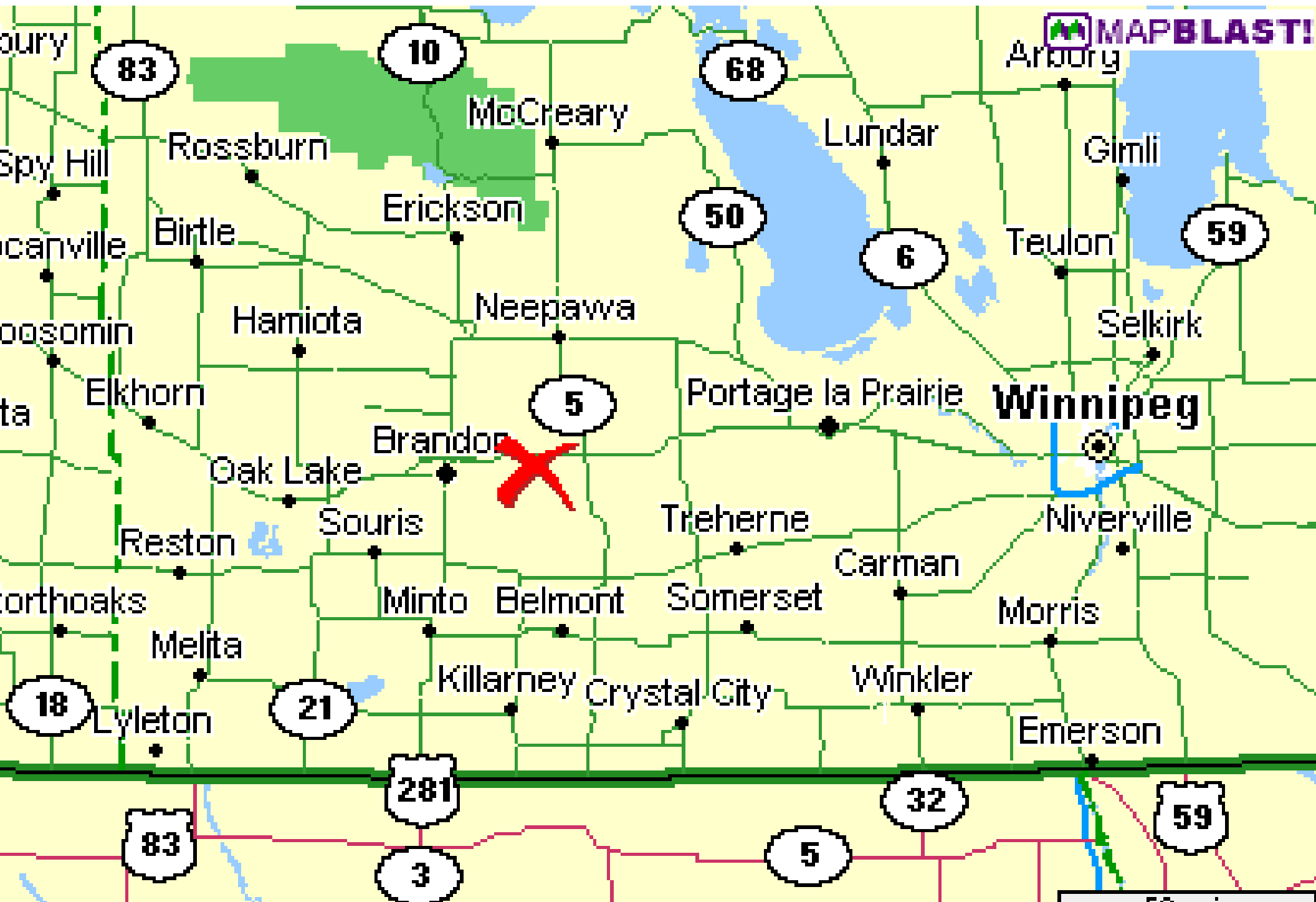
Downy mildew (*Plasmopara Halstedii*)

soil- and seed-borne pathogen

Systemic infection through roots

>70% Infected plants





Prevalence and Severity of Downy mildew

Year	Infested Fields % of Total	Mean Disease % inf. plts	Range % Inf.Plts	Prevalent Races
2007	81	8	T- 30	700, 300, 500
2006	42	5	T- 15	700, 500, 300
2005	72	8	T- 40	700, 300, 500
2004	34	5	T-15	Na
2003	30	5	T- 20	Na
2002	10	3	T- 5	Na
2001	15	4	T- 5	Na
2000	20	3	T- 5	Na
1999	10	6	T- 10	Na

Materials & Methods

- **Continuous study**
- **Collect single DM-infected plants from infected sunflower fields**
- **Test each sample on a set of 9 sunflower DM differential lines.**
 - **Germinate seed 3-days, roots 1-2 cm.**
 - **Incubate infected plant sample 24hr high RH.**
 - **Collect conidia/zoospores in water suspension.**
 - **Soak seedlings in spore suspension 20,000/ml for 3-4 hr**
 - **Transplant seedlings into soil mix in flats**
 - **Grow under controlled GR conditions for 14 days**
 - **Incubate under High RH for 24 hrs**
 - **Assess Infection and sporulation.**
- **Determine levels of susceptibility and resistance**
- **Determine Race identity of each DM sample collected.**

Susceptible and Resistant reactions



DM Races and Prevalence, 2005

Sunflower Differential Lines	Rust Races, Prevalence, and Virulence			
	100 (1) 12%	300 (2,6,7) 21%	500 5%	700-730 62%
SHA 300	S	S	S	S
RHA 266 (265)	R	S	R	S
RHA 274	R	R	S	S
DM-2 (PM1-3)	S	R	S	R-S
DM-3 (PM1-17)	S	R	R	R-S
DM-4 (803-1)	na	na	na	na
HAR 4	na	na	Na	na
HAR 5 (QHP-1)	na	na	na	na
HA 335	R	R	R	R

DM Races and Prevalence, 2004

Sunflower Differential Lines	Rust Races, Prevalence, and Virulence			
	100 (1) 8%	320 (2,6,7) 6%	500 6%	720-730 80%
SHA 300	S	S	S	S
RHA 266 (265)	R	S	R	S
RHA 274	R	R	S	S
DM-2 (PM1-3)	S	R	S	R-S
DM-3 (PM1-17)	S	S	R	S
DM-4 (803-1)	na	na	na	na
HAR 4	na	na	na	na
HAR 5 (QHP-1)	na	na	na	na
HA 335	R	R	R	R

Prevalent DM Races 2004-07

Year	Race 100 (1)	Race 300 (2, 6, 7)	Race 500 (4)	Race 700 (3)
2004	8%	6%	6%	80%
Races, Inc.	100	320	500	720-730?
2005	12%	21%	5%	62%
Races. Inc.	100	300	500	700-730?
2006	8%	16%	21%	55%
Races	100	333, 300	500, 560	733, 773, 700
2007	4%	25%	11%	59%
Races, Inc.	130	330, 300	510, 530	730, 710, 700

DM Resistance to Metalaxyl (Apron)

Methodology:

- Collect isolates from single plants.
- Inoculate untreated sunflower seedlings
- Inoculate seedlings from Apron treated seed
- Assess disease development and sporulation
- DM isolates are resistant if treated seedlings are as susceptible as untreated seedlings.

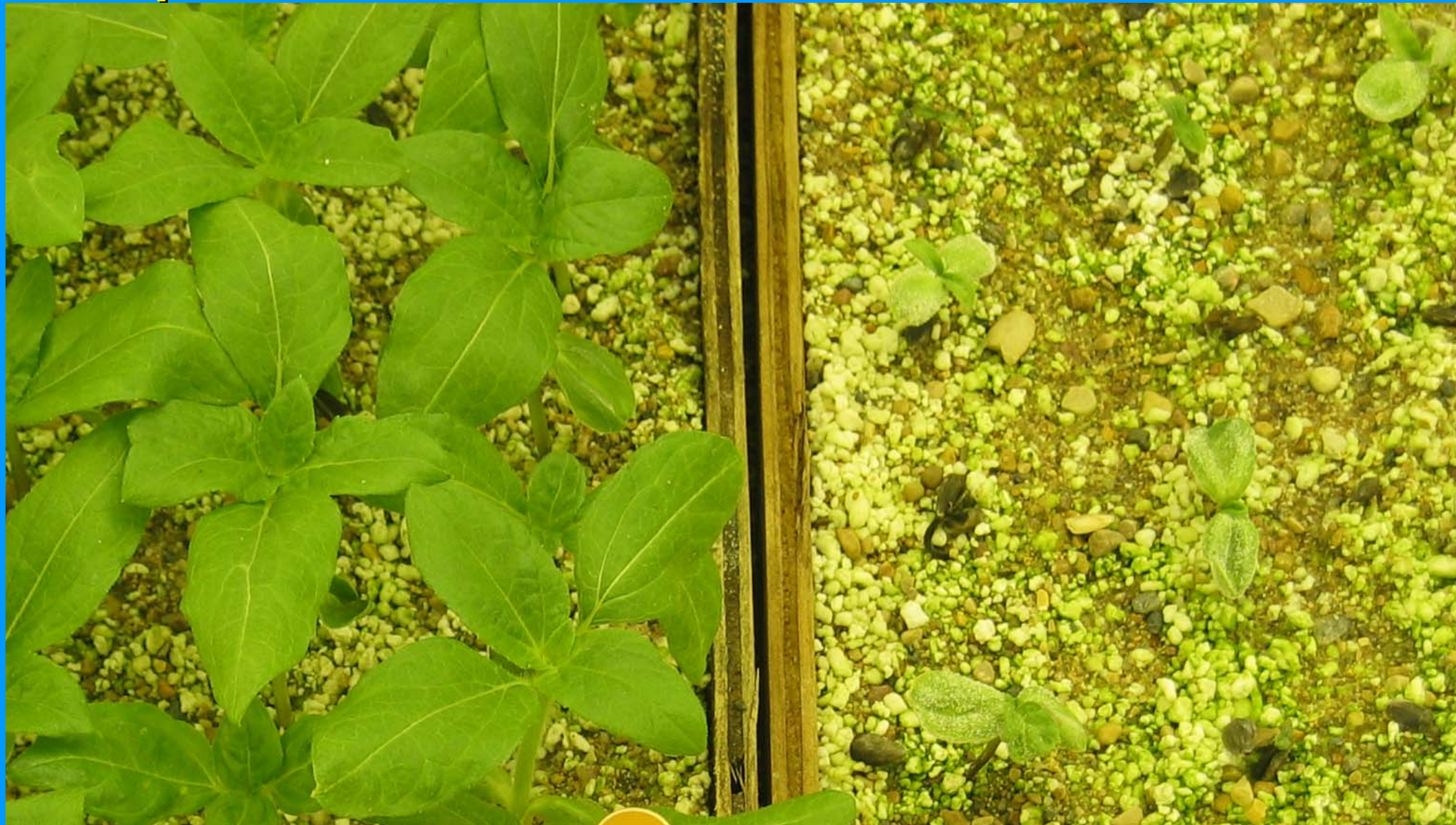
% of DM resistance

- 2005 78%
- 2006 66%
- 2007 84%

Fungicide sensitive isolate

Apron treated seed

untreated seed



Conclusions

- Major shift in sunflower DM races
- Low frequency of race 100 (original race 1)
- Low-Med frequency of race 300 (original 2,6,7)
- Low-Med frequency of race 500 (original 4)
- High frequency of race group 700 (original 3)
- High % of DM isolates are resistant to Apron (metalaxyl)
- Most commercial sunflower hybrids lack resistance to the most virulent races.
- Good News: Some new hybrids have better resistance.

ACKNOWLEDGEMENT

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MORDEN RESEARCH STATION

