



# A Major Shift in the Sunflower Rust Races in Manitoba

Khalid Y. Rashid

AAFC, Morden Research and Development Centre, Morden, MB



High virulent races are prevalent causing major losses that can be avoided by incorporating genetic resistance in sunflower hybrids

## Introduction

Sunflower (*Helianthus annuus* L.) is commonly grown in Manitoba on ~60,000 ha, ~70% confections and ~30% oilseed types. Rust *Puccinia helianthi* Schwein is a major sunflower disease worldwide. It completes its life cycle on sunflower (Figures 1 & 2) with new pathotypes every year. It drains plants of energy, causes leaf burning and defoliation, and reduces yield and seed quality. The objective of this study was to identify changes in virulence in this rust and sources of genetic resistance to help building durable resistance in commercial sunflower hybrids.

## Material and Methods

Sunflower fields have been annually surveyed in most of the crop growing areas in Manitoba. Data collected includes the rust incidence and severity based on % leaf area infected (Fig. 3). Urediospores from infected leaves were collected, suspended in petroleum oil and inoculated onto seedlings of the international set of nine rust differential genotypes (Table 2) under controlled growth room conditions. The reaction for each isolate/genotype determined the race identity of each rust isolate.

## Results and Discussion

Rust varied from year to year with severe epidemics in 2006, 2008, 2009, 2010, 2013, and 2015. In 2009, rust covered 25% leaf area infected in 70% of the crops caused by races 767, 776 and 777. Local epidemics occurred in 2011-2013 (Tables 1 to 4).

Recently, a major shift occurred from low virulent groups 100 & 500 to the high virulent groups 300 & 700 (Table 4).

The most virulent race 777 appeared in 23% of 2009 isolates but not in 2010-11 perhaps due to a lack in fitness and a sharp decline in sunflower acreage. However, race 777 re-appeared in 5-10% of the 2012-2014 isolates, and in 75% of the 2015 isolates (Tables 2-4)

Figure 3. Scale for assessing rust severity

Leaf Area Infected ~ 5% & 40% LAI

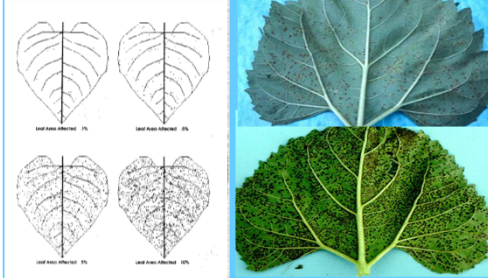


Table 1. incidence, severity, and prevalent rust races, 2006-2015

Year	% Infested Fields	Mean-Dis. % LAI	Range % LAI	Prevalent Races
2015	71%	10%	T - 40	4 ( 777, 775, 377 )
2014	84%	8%	T - 30	3 ( 377 ) , 4 ( 736, 776, 726 )
2013	55%	10%	T - 40	4 ( 736, 776, 726 )
2012	55%	5%	T - 10	4 ( 736, 776, 726 )
2011	46%	4%	T - 10	4 ( 726 )
2010	40%	10%	T - 50	4 ( 726, 736, 776 )
2009	70%	25%	T - 60	4 ( 776, 777 ) & 3 ( 336 )
2008	74%	15%	T - 50	3 ( 336, 326 ) & 4 ( 736 )
2007	57%	10%	T - 50	3 ( 300 ) & 4 ( 700 )
2006	66%	6%	T - 40	3 ( 300 ) & 4 ( 700 )

Table 2. Prevalent rust races in 2009

Sunflower Differential Lines	Rust Races, Prevalence, and Virulence, 2009											
	122 3%	324 3%	326 3%	327 3%	336 10%	337 3%	726 10%	736 10%	737 3%	767 19%	776 23%	777 23%
S-37-388	S	S	S	S	S	S	S	S	S	S	S	S
CM-90RR	R	S	S	S	S	S	S	S	S	S	S	S
MC-29-3	R	R	R	R	R	R	R	R	R	R	R	R
P-386	R	R	R	R	S	S	R	S	S	R	S	S
HA-R1	S	S	S	S	S	S	S	S	S	S	S	S
HA-R2	R	R	R	R	R	R	R	R	R	S	S	S
HA-R3	R	R	R	S	R	S	R	R	S	S	R	S
HA-R4	S	R	S	S	S	S	S	S	S	S	S	S
HA-R5	R	S	S	S	S	S	S	S	S	S	S	S

Table 3. Prevalent rust races in 2015

Differentials	375 5%	377 10%	775 10%	777 75%
S37-388	S	S	S	S
CM90RR	S	S	S	S
29-3	R	R	S	S
P386	S	S	S	S
HAR1	S	S	S	S
HAR2	S	S	S	S
HAR3	S	S	S	S
HAR4	R	S	R	S
HAR5	S	S	S	S

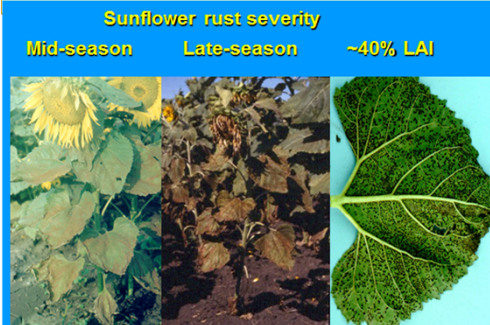
Table 4. Prevalent rust races 2003-2015

Year	Race 100 (1)	Race 300 (3)	Race 500 (2)	Race 700 (4)
2003	12%	6%	0	82%
Races	120, 126	326	-	736, 702, 736, 737
2004	20%	65%	0	15%
Races	126, 106	326, 306, 320, 336	-	726, 727
2005	0	87%	0	13%
Races	-	326, 336, 337, 376	-	736, 776, 777, 749a
2006	0	84%	4%	12%
Races	-	324, 320, 326, 336, 368	520	734
2007	0	80%	4%	16%
Races	-	336, 326, 304, 377	536	726, 736, 774
2008	0	62%	0	38%
Races	-	336, 326, 320, 324, 337	-	736, 724, 726, 734
2009	3%	23%	0	74%
Races	122	336, 337, 324, 326, 327	-	776, 221%, 777, 024%, 726, 736, 737
2010	0	0	0	100%
Races	-	-	-	726, 736, 776
2011	0	0	0	100
Races	-	-	-	726
2012	0	0	8%	85%
Races	-	-	546	736, 776, 724, 726, 777, 65a
2013	-	-	5%	85%
Races	-	-	540	776, 726, 736, 777, 65a
2014	-	-	60%	40%
Races	-	330, 337, 345, 355, 367, 375, 377	-	735, 737, 747, 757, 777, 09a
2015	-	-	15%	85%
Races	-	-	375, 377	777, 026%, 775 (19%)

Figure 1. Sunflower rust aecial stage on cotyledon and early true leaves.



Figure 2. Uredial and Telial stage devastating sunflower.



## Conclusions

- Frequent rust epidemics, 2006-2015.
- Low rust epidemics in 2011-2013.
- Low frequency of the low virulent race-groups 100 & 500.
- Shift to high virulent races 300/700.
- In 2009: 726, 736, 737, 776 = 52%  
777 = 23%.  
324, 326, 327, 336 = 25%.
- In 2010-11: 726, 736, 766, 776 = 100%.
- In 2012-13: 724, 726, 736, 776 = 90%  
777 = 5%.
- In 2014: Race-group 300 = 60%  
Race-group 700 = 40% 777 = 10%.
- In 2015: Race-group 300 = 15%  
Race-group 700 = 85%, 777 = 75%.
- The new Races are virulent on most commercial sunflower hybrids

## Acknowledgements

- ▶ Agriculture and Agri-Food Canada (AAFC)
- ▶ Technical Assistance: Tricia Cabernel Maurice Penner, Suzanne Enns,

