

New Virulent Races of Downy Mildew:

Distribution, Status of DM-Resistant Hybrids, and USDA Sources of Resistance

Tom Gulya, USDA-ARS-NCSL

Sam Markell & Marcia McMullen – NDSU, Fargo

Bob Harveson – U NEB, Scottsbluff

Larry Osborne, SDSU,- Brookings



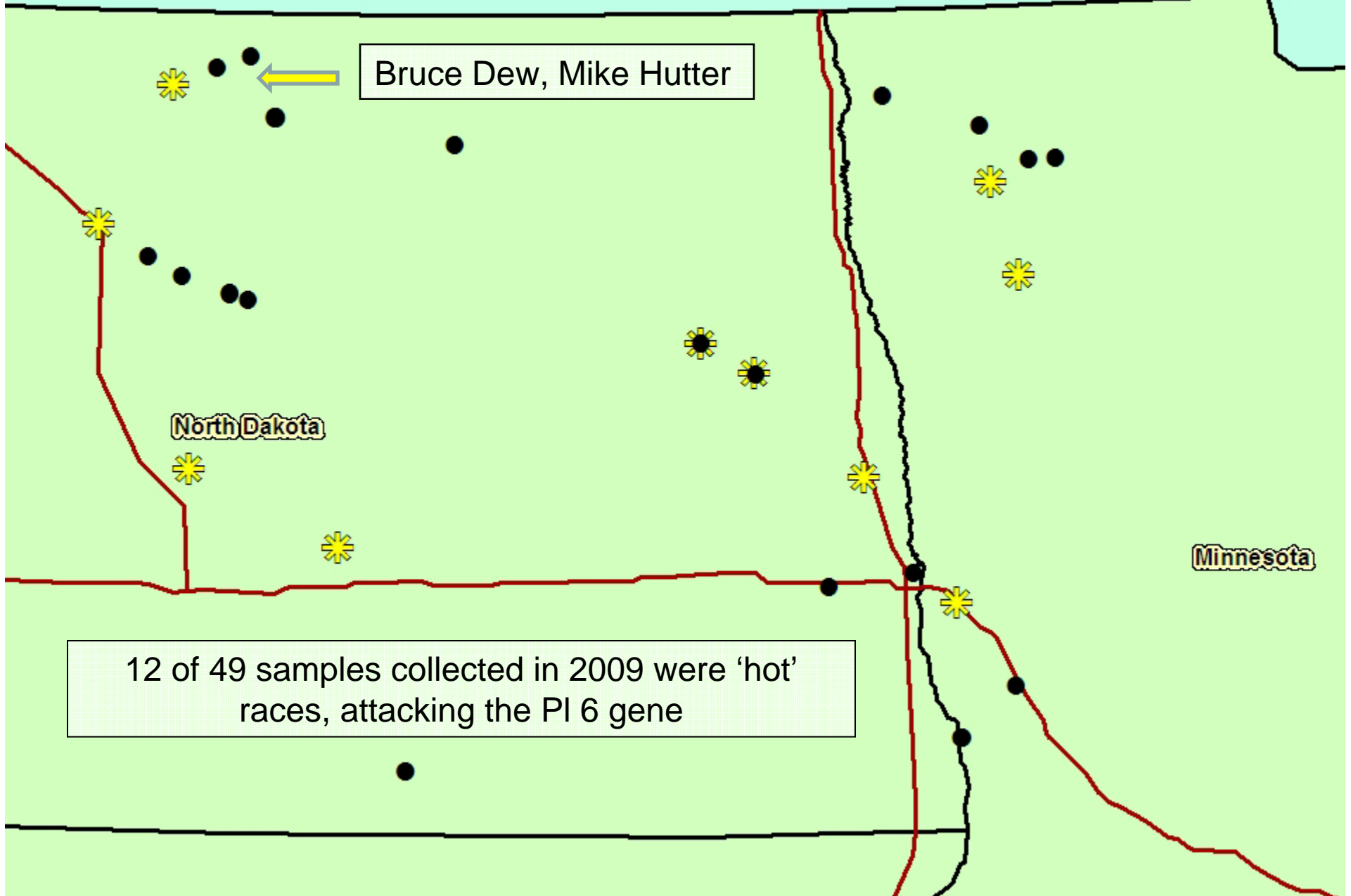
Background

- Sunflower downy mildew exists as many 'physiological races,' controlled by 15 dominant resistance genes.
- In the U.S., 11 races have been identified (2000-2008) from ~ 350 samples processed by the USDA unit.
- Race 730 dominant (42%), and with race 770, comprise two-thirds of all isolates.

Background

- Worldwide, **36** races have been identified, with four dominant (700, 710, 730, 770).
- First race to overcome PI_6 (304) found in France (2000).
- In 8 years, six more “hot” races have been identified in France (307, 314, 334, 704, 707, 714).
- In the U.S., no DM sample has been found that overcomes the PI_6 gene (HA-335) since it was released in 1988..... Until 2009 when the first ‘hot’ (734) was identified.

2009 Distribution of New Hot Downy Mildew Races



2010 Studies

- Larger, *unbiased* multi-state mildew collection to determine distribution of new races.
- Determine which USDA released lines have resistance to new races
- Evaluate “DMR” commercial hybrids
- ***FUNDED BY NSA GRANT***

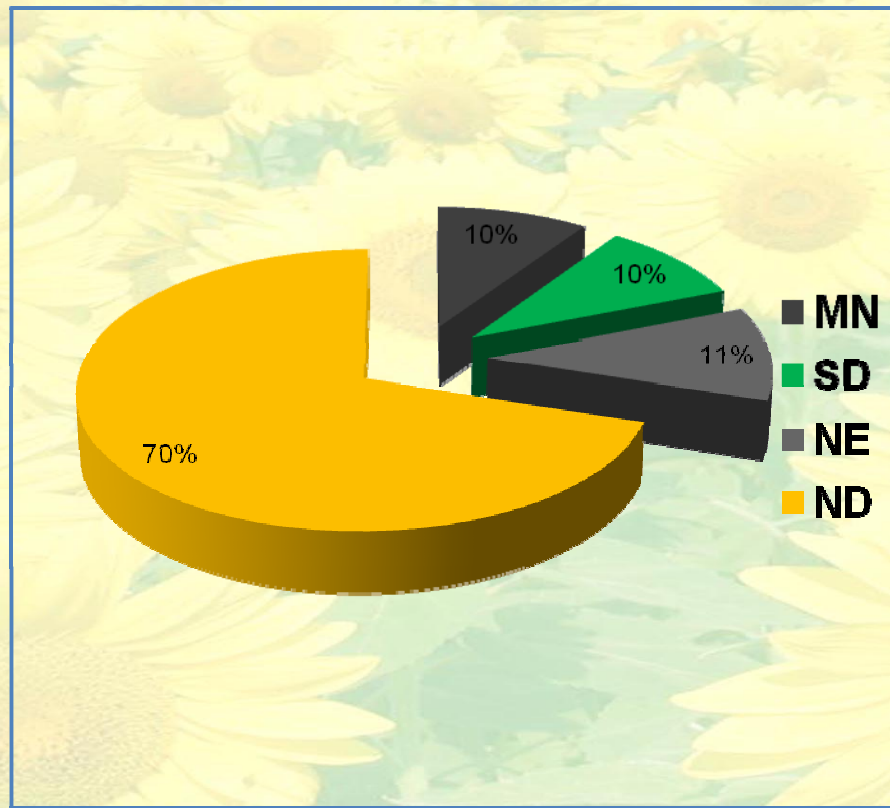
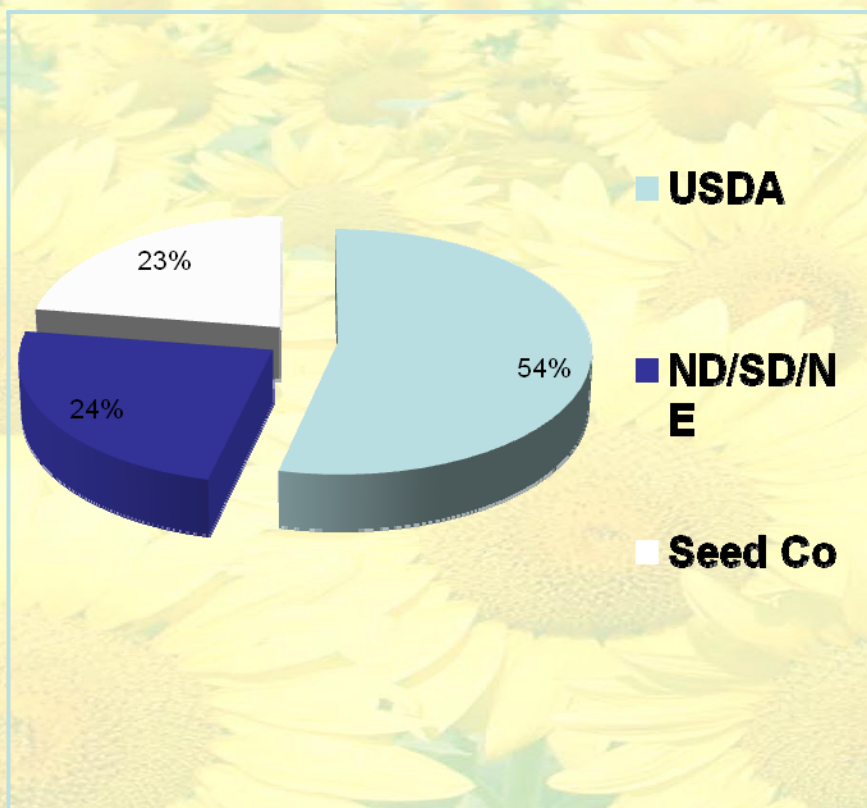
2010 Downy Mildew Surveys

- With aid of extension personnel in ND, SD, and NEB, plus help from seed companies and USDA – find/collect viable mildew specimens from ND, SD, MN, NE, CO.

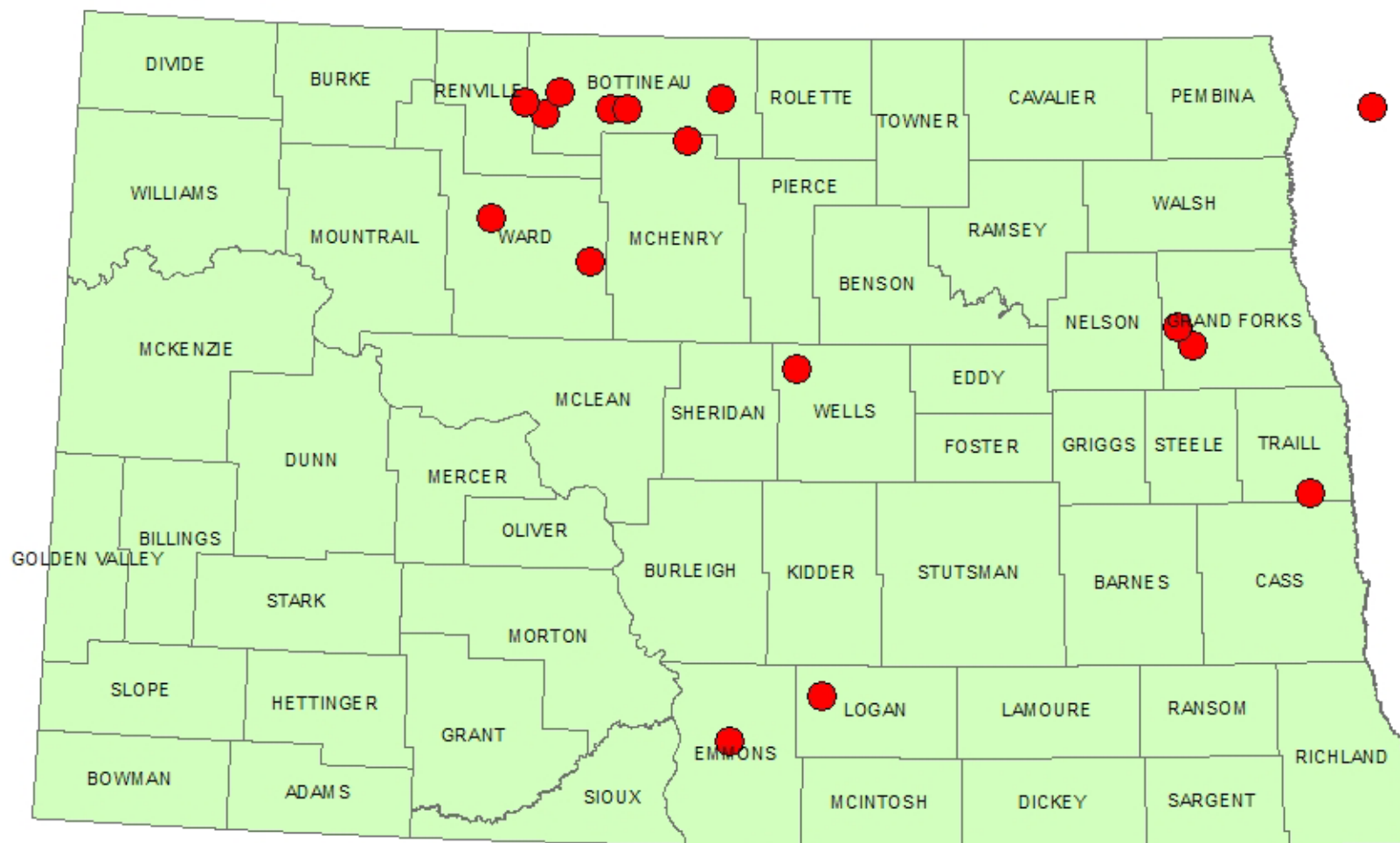


2010 Sunflower Downy Mildew Study

– Origin of 160 samples



Downy Mildew Locations



17 isolates of 160 collected in 2010 were 'hot' races attacking the PI6 gene. Found in ND, MN and NE. Not in SD, KS or CO.

North central ND continues to have greatest concentration of 'hot' races... also had high May/June rains

Reaction of New Races on Differentials

Differential	DM 314	DM 704	DM 714	DM 734	DM 774
Susc	S	S	S	S	S
RHA 265	S	S	S	S	S
RHA 274		S	S	S	S
DM-2	S		S	S	S
PM-17				S	S
803					S
HAR-4					
HAR-5					
HA-335	S	S	S	S	S

Reaction of New Races on Other “DMR” USDA Germplasm

Differential	DM 314	DM 704	DM 714	DM 734	DM 774
<i>HA 337 (PI 7)</i>	S	S	S	S	S
<i>RHA 340 (PI 8)</i>	R	R	R	R	R
<i>HA 419 (PI arg)</i>	R	R	R	R	R
<i>HA 458</i>	R	R	R	R	R
<i>HA 428</i>	R	R/S	R	R/S	R
<i>RHA 464</i>	<i>seg</i>	<i>seg</i>	<i>seg</i>	<i>seg</i>	<i>seg</i>
<i>TX 16</i>	<i>seg</i>	<i>seg</i>	<i>seg</i>	<i>seg</i>	<i>seg</i>

Downy Mildew Resistance in Commercial Sunflower Hybrids

- Several companies have hybrids on the market listed as “DMR” or mildew resistant.
- Hybrids with Pl_6 or Pl_7 resistance all susceptible.
- 2010 – 37 hybrids submitted from 6 companies for testing with five new races
- 3 hybrids resistant to all five races, 8 hybrids R/S or segregating, 26 Susceptible to all five races
- Resistant hybrids: Croplan 325 and 555, Mycogen Exp. 0485.

Summary of 2009/10 Downy Mildew Hot Races

		DM 314	DM 704	DM 714	DM 734	DM 774	Total
2009	# isolates	-	-	8	4	-	12 of 49 = 24%
	Location			MN (2), ND (6)	ND		
2010	# isolates	3	1	6	4	3	17 of 160 = 11%
	location	ND, NE, MN	ND	ND	ND	ND	

Summary – 1

- *New races able to overcome the Pl_6 gene (HA-335, 336) and the Pl_7 gene (HA-337, 338, 339) comprised 14% of 209 samples tested in 2009 and 2010.*
- *Five new ‘hot’ races found in two years – mostly in ND, but also in MN and NE (none from SD).*

Summary – 2

- Resistance to new races is available in released USDA lines, notably RHA 340, RHA 419/420, HA 428 and HA 458.
- Expanding the potential pool of resistance genes by exploring wild *Helianthus* is advisable, and transferring genes into elite germplasm combined with other traits will be a unit objective.

Summary – 3

- Most commercial hybrids marketed as “DMR” are now susceptible to the new races.
- A few hybrids are available which are resistant to ALL five new races.

Thank you -

