Evaluation of *Helianthus* germplasm for resistance to *Plasmopara halstedii* (downy mildew) and *Puccinia helianthi* (rust)

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Challenges and Limiting Factors

Disease- #1 biological yield-limiting factor

1. Downy mildew
   - *Plasmopara halstedii*

2. Rust
   - *Puccinia helianthi*
Challenges and Limiting Factors

Disease - #1 biological yield-limiting factor

1. Downy mildew
   – Plasmopara halstedii

2. Rust
   – Puccinia helianthi
Downy Mildew Symptoms

Photos: Friskop
Downy Mildew Yield Losses

Photo: Markell
Challenges and Limiting Factors

Disease- #1 biological yield-limiting factor

1. Downy mildew
   – *Plasmopara halstedii*

2. Rust
   – *Puccinia helianthi*
Challenges and Limiting Factors

Disease- #1 biological yield-limiting factor

1. Downy mildew
   – *Plasmopara halstedii*

2. Rust
   – *Puccinia helianthi*
Symptoms and Signs

Photos: Markell
Management

• Genetic resistance is an effective management tool for both diseases

• Resistance genes are frequently overcome

• New sources of resistance are needed
Sources of resistance

- North American collection of wild *Helianthus* germplasm previously screened

- A disproportionate amount of resistance genes have been identified in germplasm originating from Texas

http://www.flowerpictures.net/flower_database/c_flowers/common_sunflower.html
Objective

Identify new potential sources of resistance to:
1. *Plasmopara halstedii*
2. *Puccinia helianthi*
Materials and Methods

Host

- Wild *Helianthus* accessions derived from Texas
  - 182 *H. annuus*
  - 33 *H. argophyllus*
  
  - Obtained from the USDA North Central Regional Plant Introduction Station

Pathogen

- *P. halstedii* and *P. helianthi* isolates collected from North Dakota
  - Commonly detected races
  - Highly virulent races

Photo: Humann
Inoculation and Evaluation

Downy Mildew

- Seedlings were inoculated with *P. halstedii* zoosporangia
- Incidence was evaluated 11 days post-inoculation
  - % Resistance = Resistant plants / Total plants

Photos: Humann
Results

1. Downy mildew
   – *Plasmopara halstedii*

2. Rust
   – *Puccinia helianthi*
Downy Mildew

*P. halstedii*

**Common Race**

**H. annuus**

**Highly Virulent Race**

**H. argophyllus**

Percent Resistance

*H. annuus* accessions (n=182)

Most Resistant

10%
Downy Mildew
*P. halstedii*

H. annuus accessions (n=22)

18 accessions with resistance >70%

Common Race

Highly Virulent Race

H. annuus

H. argophyllus
Downy Mildew

*P. halstedii*

Common Race

Highly Virulent Race

- *H. annuus*
- *H. argophyllus*

Most Resistant

10%

H. argophyllus accessions (n=33)
Downy Mildew

*P. halstedii*

- **Common Race**
- **Highly Virulent Race**

**H. annuus**

**H. argophyllus**

3 accessions with resistance >70%
Inoculation and Evaluation

Rust

• Plants inoculated 14 days after planting with *P. helianthi* urediniospores

• Infection types were evaluated 14 days post-inoculation
  - % Resistance = Resistant plants / Total plants

Resistant Reactions
(0, , , 1, 2)

Susceptible Reactions
(3, 4, 5)

Photo: Humann
Results

1. Downy mildew
   – *Plasmopara halstedii*

2. Rust
   – *Puccinia helianthi*
Rust

*P. helianthi*

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**H. annuus**

- Common Race
- Highly Virulent Race

**H. argophyllus**

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Most Resistant
10%
Rust

*P. helianthi*

22 accessions with resistance >70%

- **Common Race**
- **Highly Virulent Race**

**H. annuus**

**H. argophyllus**

*H. annuus* accessions (n=22)
Rust

*P. helianthi*

Common Race

Highly Virulent Race

**H. annuus**

**H. argophyllus**

**H. argophyllus** accessions (n=33)

Most Resistant

10%
Rust

*P. helianthi*

4 accessions with resistance >70%
Accessions resistant to both pathogens

H. annuus

H. argophyllus

Percent Resistance

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Conclusions and Future Work

• Accessions resistant to both pathogens were identified
  – Seven *H. annuus*
  – Three *H. argophyllus*

• Future work will focus on characterizing the genes conferring resistance in these accessions
Acknowledgements

- USDA North Central Regional Plant Introduction Station
- National Sunflower Association
- North Dakota Agricultural Experiment Station
- DuPont Crop Protection
- NDSU Plant Path Ext. Group
Questions