Traits for Resistance to Sunflower Moth Larval Feeding in Inbred, Hybrid, and Wild Sunflower

Jarrad Prasifka, Brent Hulke
USDA-ARS-NCSL, Fargo, ND
Approaches to Plant Resistance Work

• In-field screening for % damage
  – Expensive and slow
  – Results inconsistent

• Selecting for specific plant traits
  – If valued traits are identified...
  – Can have reliable evaluation and breeding
  – In-field insect work, still needed – for validation
Previous Work on SM Resistance Traits

• **Pericarp hardness**
  - Variation can reduce SM damage
  - Linked to phytomelanin layer (Pml)

• **Glandular trichomes (w/ terpenoids)**
  - Toxic or repellent to several spp.
  - Believed to protect wild SF
  - Uncommon in cultivated SF (?)
Limitations of Previous Work

• Pericarp hardness
  – Inbreds last tested in 1980’s
  – Data primarily from greenhouse tests
  – Value of Pml versus innate hardness unclear

• Glandular trichomes
  – Germplasm last tested in 1980’s
  – Data collected, not publicly disclosed
  – Link of trichome # to resistance not shown
SM Traits in Local Field Trials (2012)

• Pericarp hardness (53 entries)
  – 15 each of RHA, HA, hybrids
  – 4 PI or interspecific w/ SM resistance
  – 5 plants @ 7, 14, 21 d after pollen shed

• Glandular trichomes
  – Above plus 15 wild PI (KS, TX, ND)
  – Collected florets just prior to anthesis
  – Counted for 3 florets × 3 plants
Pericarp Resistance Trends

N = 0.24d – 0.51; $R^2 = 0.91$
Pericarp Resistance, by Group @ 14 d

Germplasm group

HA
RHA
Hybrid
Resistant

Side puncture force, Newtons (± SE)

HA
RHA
Hybrid
Resistant

B
C
B
A
Pericarp Resistance, within HA @ 14 d

Side puncture force, Newtons (± SE)
Pericarp Resistance, Larval Feeding Test

- **Preliminary testing**
  - Groups of 1.5, 2.8, 3.7 strength
  - Resistance at ≈ 3.0 N?
  - 4th instar can start @ 11 days

- **Strength of 3.0 N reached at:**
  - 11 days for PI 170415
  - 14 days for HA 300
  - 19 days for HA 301
Pericarp Resistance, Summary

• **Pericarp hardness**
  – Room to improve USDA inbreds
  – Hardness of PI 170415 appears valuable
  – PI resistance may be enhanced by R-line

• **Winter–Spring 2013**
  – Assess breeding material based on PI 170415
  – Conduct additional SM feeding tests
Glandular Trichomes, Results & Summary

- **Gland numbers**
  - HA ≈ Hybrids ≈ Wilds > RHA
  - Relationship with terpenoid content?
Future Directions, Acknowledgements

• Priorities for future
  – Determine relative contribution of Pml, hardness
  – Specifics on terpenoid ID and quantification
  – Work towards mapping both traits

• Gerald Seiler - background on previous efforts

• Theresa Gross - pericarps & gland counts (> 100K)