

Resistance of Sunflower Germplasm to the Sunflower Stem Weevil & Red Sunflower Seed Weevil & Evaluation of Commercial Hybrids for Resistance to the Sunflower Midge



Larry Charlet¹, Brent Hulke¹, Anitha Chirumamilla²,
Gerald Seiler¹, Theresa Gross¹, Kathy Grady³,
Jan Knodel², & Rob Aiken⁴

¹ USDA-ARS, NCSL

² NDSU Entomology Dept.

³ SDSU Plant Science

⁴ KSU Northwest Res & Ext Center

Project Objectives

- × Host-plant resistance is an important component in the development of an integrated pest management program.
- × Our program for the past several years has focused on the evaluation of germplasm (accessions, interspecific crosses, & lines) for:
 - + Reduced larval densities of the sunflower stem weevil & lower damage from the red sunflower seed weevil.

Project Objectives

- × We have also continued to evaluate hybrids for tolerance to larval feeding by the sunflower midge & also have included:
 - + the sunflower seed maggot & sunflower bud moth
- × Identification of germplasm that has either reduced density of insects or lower damage has provided breeding material that eventually will be released to be incorporated into hybrids targeted to regions where specific insect problems occur,

Research Locations for Resistance Studies



Mapleton, ND
Sunflower Midge



Highmore, SD
Red sunflower seed weevil



Colby, KS
Sunflower stem weevil

Colby, KS Nursery



Sunflower Stem Weevil

Adult



Egg sites below cotyledon

Larvae



Overwintering site



Feeding damage to stalk

Evaluation procedures

- Nursery location in area that has consistently high weevil populations.
- Early planting date to ensure infestation.
- Stalks harvested after dry-down & sent to Fargo for evaluation.
- Stalks split & number of larvae per stalk determined.

Highmore, SD Nursery



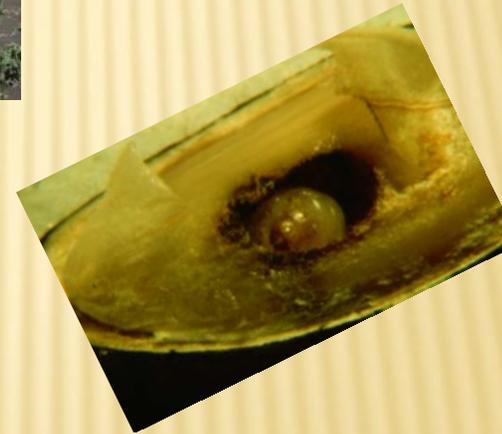
Red sunflower seed weevil

Adult



Evaluation procedures

- Nursery located in area that has produced high seed weevil damage.
- Late planting date to ensure infestation.
- Heads harvested after maturity & sent to Fargo for evaluation.
- Heads threshed & number of percentage of damaged seed determined.



Larva feeding in sunflower kernel



Exit holes of larvae from seeds

Mapleton, ND Nursery



Sunflower Midge



Adult



Larvae

Evaluation procedures

- Nursery located in area that has had midge damage for 20+ years.
- Early planting date to ensure infestation.
- Heads evaluated after flowering for visible damage by midge larval feeding.
- Heads also assessed for damage by: sunflower seed maggot & sunflower bud moth.

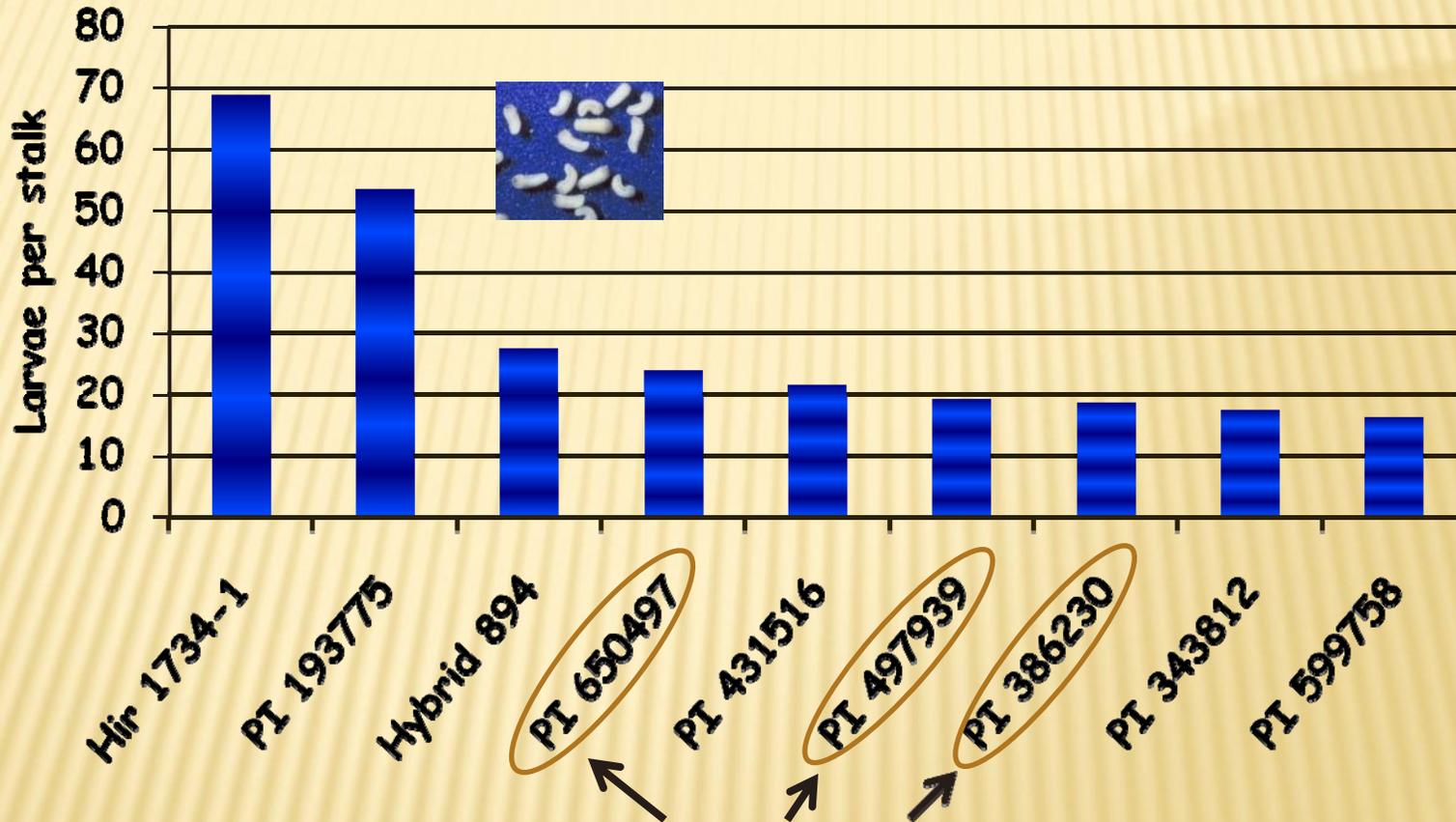
Damage to sunflower heads



Sunflower Stem Weevil Trial 2008



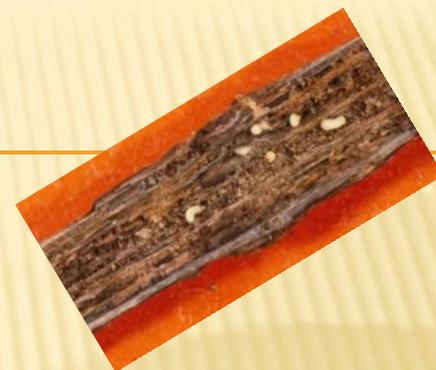
30 accessions or interspecific crosses tested



Tested 6 years
means = 11.8, 11.7, 13.1

Colby, KS

Sunflower Stem Weevil Trial 2008



S1 Lines

- 37 evaluated including checks
- Range of infestation = 57.3 to 13.2 larvae/stalk
- Plot mean = 30.8 larvae/stalk
- 12 were below 25 larvae/stalk

F_{2:3} Lines

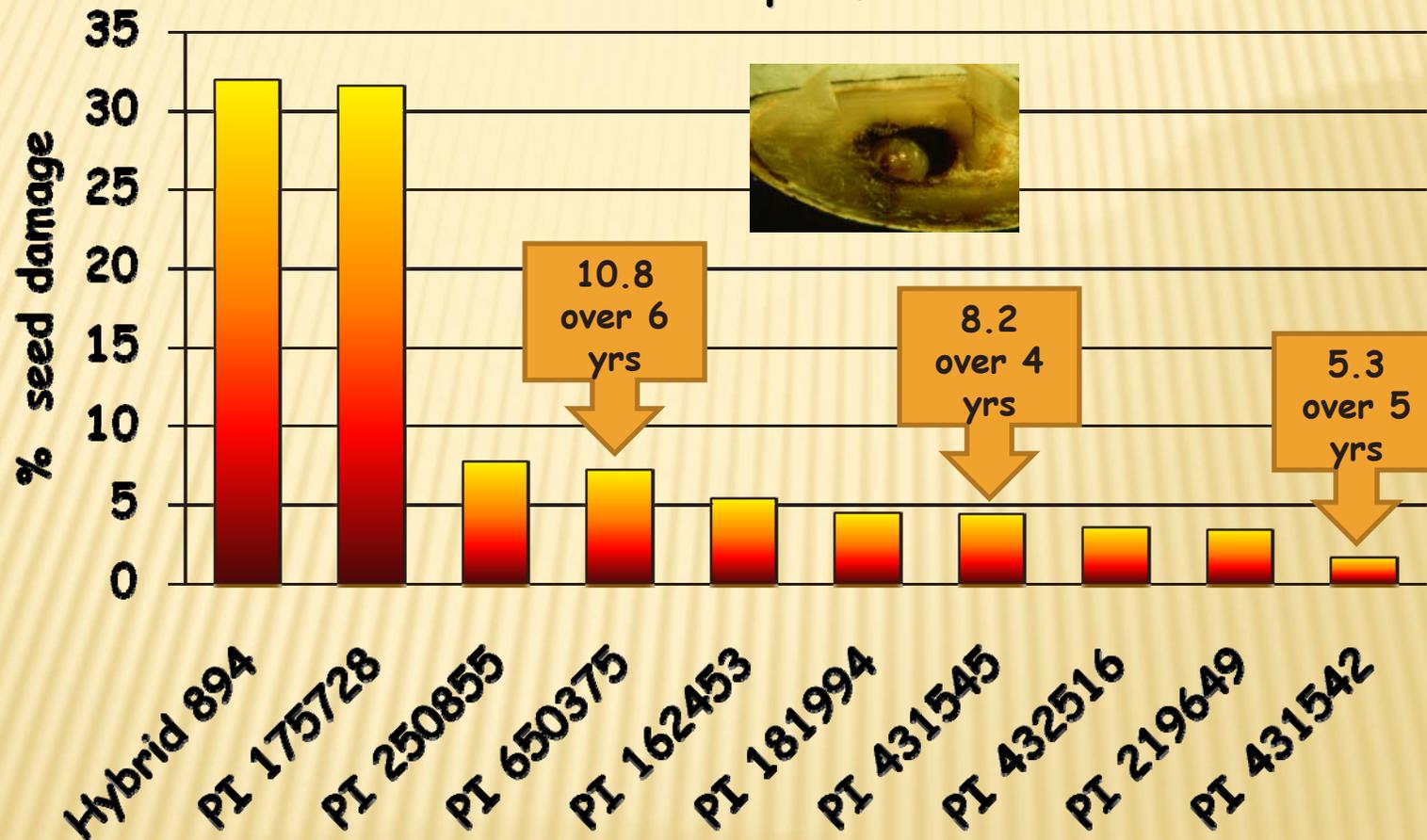
- 52 evaluated including checks
- Range of infestation = 50.8 to 10.4 larvae/stalk
- Plot mean = 29.2 larvae/stalk
- 19 were below 25 larvae/stalk

Colby, KS

Red Sunflower Seed Weevil Trial 2008



25 accessions or interspecific crosses tested



Highmore, SD

Red Sunflower Seed Weevil Trial 2008



S1 Lines

- 36 evaluated including checks
- Range = 30.8 to 0% seed damage
- Plot mean = 11.8% seed damage
- 16 were below 10% seed damage

F_{2:3} Lines

- 47 evaluated including checks
- Range = 27.0 to 1.6% seed damage
- Plot mean = 11.2% seed damage
- 25 were below 10% seed damage

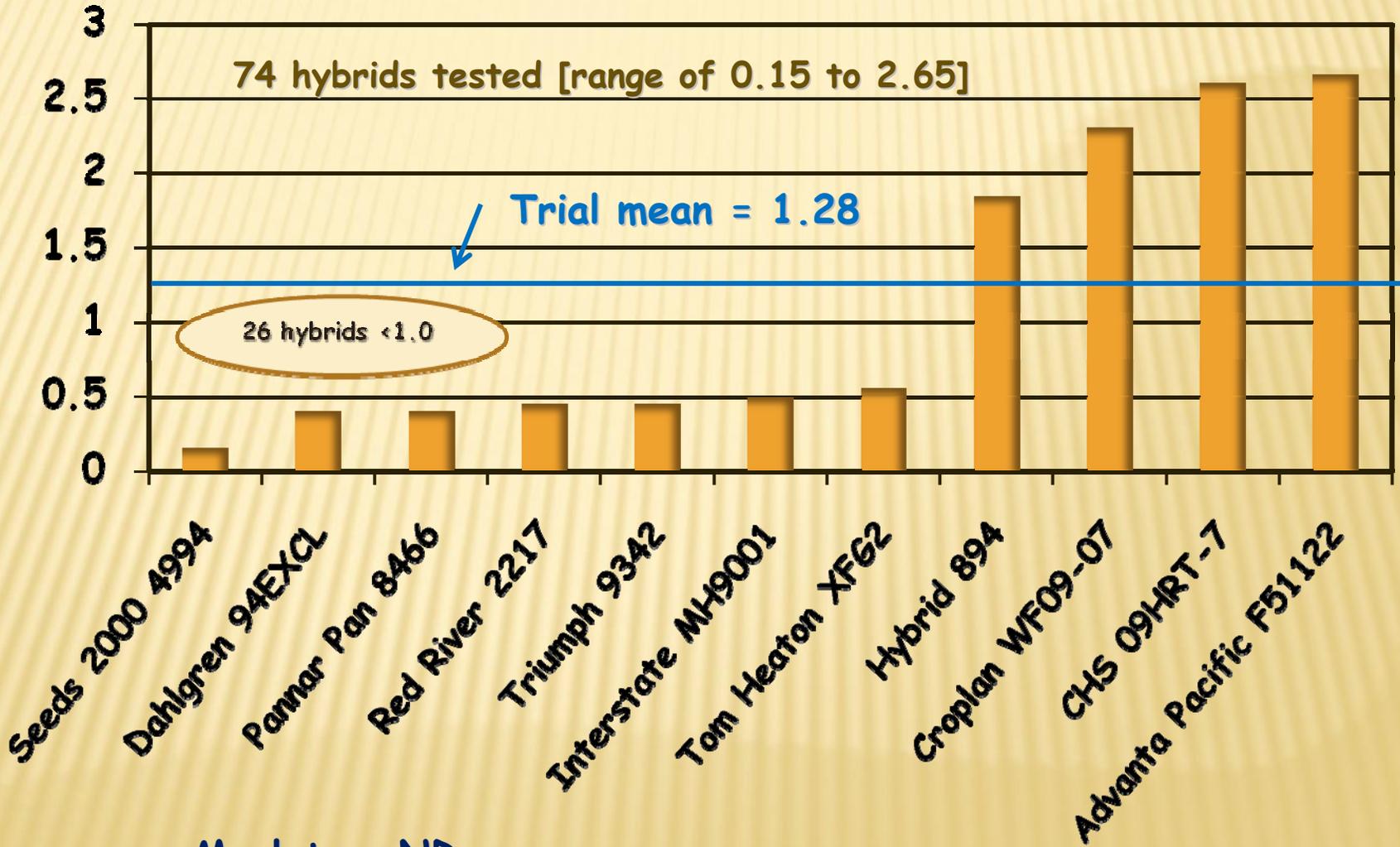
Highmore, SD

Sunflower Midge Hybrid Trial 2009



head = 4

Necrosis Index
 (5=50% or > of each quadrant with necrosis from midge feeding)



Mapleton, ND

Evaluation of Hybrids at Mapleton, ND 2009

Sunflower seed maggot

- × 74 hybrids
- × Injury rating 0 to 5
(5=feeding damage extending through all quadrants of head)
- × Range = 0 to 1.3
- × 24 with 0 damage
- × only 3 > 0.5



Sunflower bud moth

- × 74 hybrids
- × % of head with visible feeding injury
- × Range 0 to 10%
- × 52 = 0%
- × 20 = 5%
- × 2 = 10%



Conclusions & Future Research

- × Results confirmed promising germplasm previously identified & evaluated some new accessions for both seed weevil & stem weevil.
- × Trials also retested some of the S1s & F_{2:3} lines from previous years for both insects.
- × The best S1s were random-mated in 2009.
- × Some F_{2:3} lines were selfed in 2008 & were evaluated as F_{3:4} lines in 2009. These lines were self-pollinated in 2009 which will result in F_{4:5} lines & 1st generation test hybrids for further testing.

Conclusions & Future Research

- Sunflower midge was present in the Mapleton nursery, but populations were again at low densities.
- Necrosis index measured on a 0-5 scale averaged 1.3 for the trial with 26 out of 74 hybrids with less than a reading of 1.0.
- Ratings for seed maggot damage (0-5) showed reduced injury from this pest. 24 of 74 hybrids had no damage & only 3 had 0.5 or greater.
- Bud moth damage was very low in the trial with 52 of 74 hybrids showing no damage.



The Research Continues