Update on Host Plant Resistance Studies of Sunflower Moth and Banded Sunflower Moth

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Research Objectives

- Screen various sunflower accessions and new crosses for resistance to banded sunflower moth and sunflower moth

- Determine the mechanisms of resistance such as antixenosis, antibiosis, and tolerance

- Determine the plant factors (physical and chemical) contributing for antixenosis and antibiosis
Screening for Resistance Mechanisms-2008

• Research plots were established at Prosper, ND

• 4 resistant accessions- *Pl 170415, Pl 170386, Pl 431542* and Res 834-1 were evaluated with PAR 1673-2 and Hybrid 894 as checks

• Experimental design- Randomized Block Design with 3 replications

(Cont....)
• At R3-R4 stage number of eggs were counted on outer whorl of bracts using a head-mounted 3.5X magnifier (4 heads per row)

• Individual heads were color coded and bagged at R6 stage

(Cont...)
• Bagged heads were harvested (1-2 October) and taken to Fargo for evaluation

• Each head was evaluated for total number of larvae, damaged seed, and total number of seed

• A minimum of 30 larvae from each head were dissected for the presence and absence of parasites
Mechanisms of resistance for banded sunflower moth
Prosper- 2009

Significantly lower egg and larval numbers

Antixenosis
Mechanisms of resistance for banded sunflower moth
Prosper- 2009

Significantly lower egg, larval numbers and seed damage

Antibiosis or Tolerance

Antixenosis

Hybrid 894 (Resistant Check)  PAR1673-2 (Susceptible Check)  PI 170386  PI 170415  PI 431542  Res 8341

No. Eggs  No. of Larvae  % Seed Damage
Mechanisms of resistance for banded sunflower moth
Prosper- 2009

Hybrid 894
(Resistant
Check)
PAR1673-2
(Susceptible
Check)
PI 170386
PI 170415
PI 431542
Res 8341

Avg. Larval Wt. (mg)
Mechanisms of resistance for banded sunflower moth
Prosper- 2009

Hybrid 894 (Resistant Check)
PAR1673-2 (Susceptible Check)
PI 170386
PI 170415
PI 431542
Res 8341

% Parasitism
Sunflower bract hairiness Vs Egg laying preference of banded sunflower moth

Larvae in rearing rooms

Tested lines in Greenhouse

Cage studies with sunflower heads and adult moths
Procedures

✓ Approximately 20,000 banded sunflower moth larvae were collected from mature sunflower heads in 2008

✓ Adult moths were reared in rearing chambers

✓ Resistant and susceptible sunflower lines were grown in greenhouse in spring 2009

✓ 4 sunflower heads (R3) were offered to freshly emerged female moths and male moths (15 female and 10 male) randomly in a 2x2 ft cage

✓ Heads removed after 5 days and counted for eggs and bracts from the same heads are used to count the hair density in 0.5 cm²
Resistance Mechanisms for BSM-Greenhouse Study 2009

Effect of Bract hair density on BSM oviposition

Sunflower Inbred Lines

Egg Number

Bract hair density hairs / 0.5cm²

848-2  850-3  852-3  872-5  875-7  877-1  897-7  899-6  901-1

HA-445  HA-458  HA-467

Resistant

Susceptible
BSM Oviposition vs. Bract Hair Density Correlation

\[ r = 0.23 \]
\[ P < 0.03 \]
Screening for Sunflower moth Resistance-2008

- Plots were established at Northwest Research Extension Center, Kansas State University, Colby, Kansas

- Evaluated 36 accessions, 25 S1s, and 43 new crosses with Hybrid-894, Str 1622-2 and Hir 1734 as checks

- 5 heads from each row were harvested and shipped to Fargo for evaluation
Screening for Sunflower moth Resistance-2008

36 accessions and interspecific crosses were evaluated
Screening for Sunflower moth Resistance-2008

**S1’s**
- 25 S1’s were evaluated along with checks
- Seed damage ranged from 1.2% to 84.4
- 8 S1s had lower than 15% seed damage

**F2:3**
- 43 new crosses were tested along with checks
- Seed damage ranged from 1% to 53%
- 24 crosses showed less than 15% seed damage
Head Moth Damage with Bird Damage - 2008
Summary and Future Research

- Results of 2008 sunflower head moth study were not satisfactory because of heavy bird damage.

- Promising germplasm has been identified for both the insects and some of these are used in new crosses whose $F_{3:4}$ generation crosses were evaluated in 2009.

- $F_{4:5}$ generation will be tested as 1st generation hybrids in 2010.

- Screening of sunflower germplasm (new and retested) for resistance to banded sunflower moth and sunflower head moth was continued in 2009 and 2010.
Summary and Future Research

- It appears that the physical factor of sunflower bract hairiness plays an important role in banded sunflower moths preference for laying eggs.

- Greenhouse study to determine the effect of bract hair density on oviposition preference of banded sunflower moth will be repeated in spring 2010.

- Studies for determining the mechanisms of resistance will be continued.
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