Determining the Host-Plant Resistance Mechanisms for Banded Sunflower Moth

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What is Host-plant resistance?

Any inherited character by plants that lessen the effect of attack by pest.
Environmentally safe and Cost effective

3 mechanisms

1. Antixenosis- Plant characteristics that lead insects away from host plant (non-preference)
2. Antibiosis- Plants adversely affect insect biology
3. Tolerance- Plants survive even with insect attack

Objectives

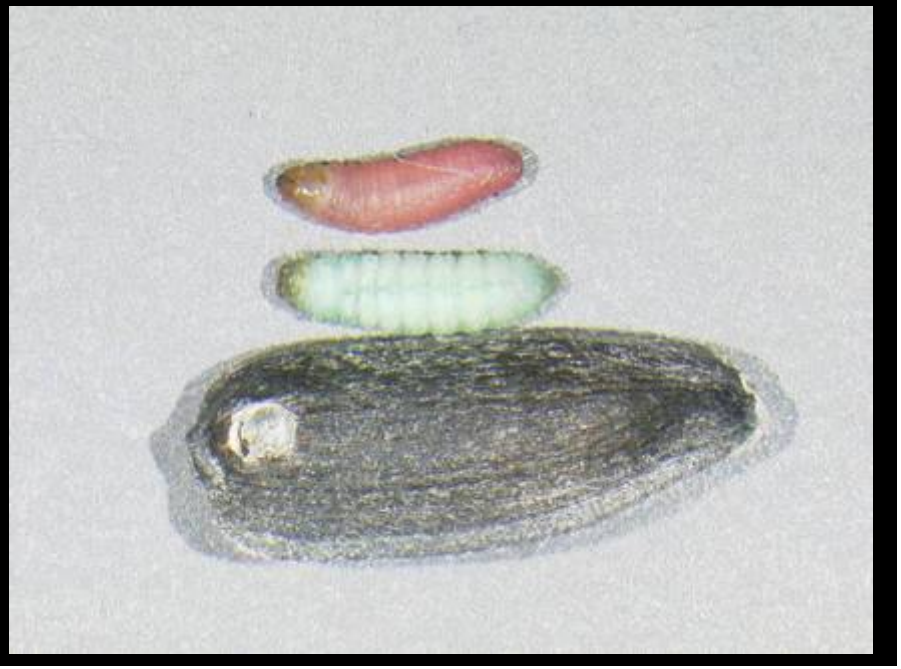
1. To evaluate sunflower germplasm for resistance to banded sunflower moth

2. To determine the mechanisms (antixenosis, antibiosis, and tolerance) enabling resistance in selected sunflower lines

Introduction

Banded sunflower moth is a serious economic pest in the northern Plains also occurs in the central Plains

Damage is by larval feeding in the heads causing reduced yields from seed loss and lower oil content



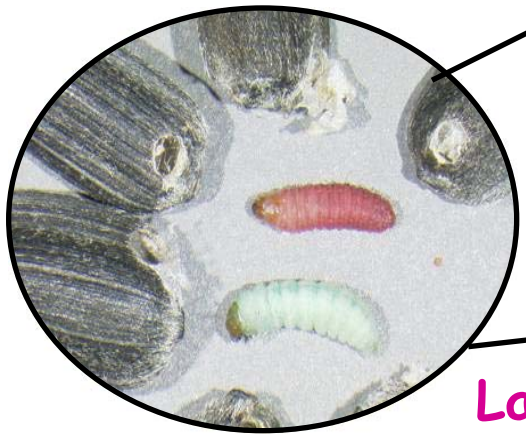
Life Cycle- Banded Sunflower Moth

Adult moth

June-Aug

Eggs laid on bracts

July-Sept



Larvae feed on florets and seeds

Oct-April

Larvae exit from seed and drop to ground

Pupa

May-June

Host-plant Resistance to BSM-2008

Two Steps...

1. Selecting the germplasm with least seed damage.

2. Screening the germplasm for oviposition, larval numbers and seed damage

Germplasm Selection

- Several sunflower accessions and interspecific crosses (IC) were evaluated for resistance to BSM from 2004-2007

- 3 resistant and 2 susceptible lines were selected for 2008 trials based on % seed damage

Screening for Resistance Mechanisms-2008

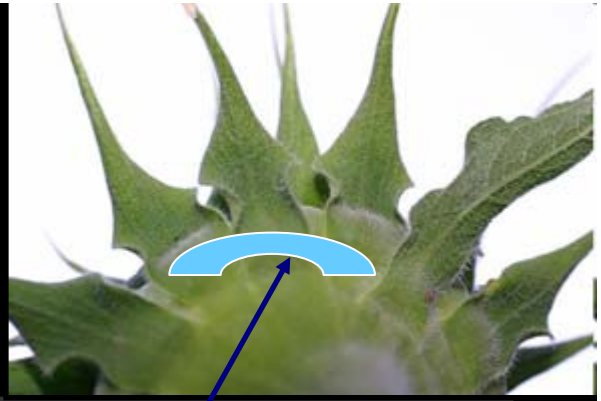
- Research plots were established (15 May) at Prosper, ND
- 3 resistant accessions- *PI 494859*, *PI 175728*, and *PI 251902* and 2 susceptible checks- *Par 1673-2* (IC) and *PI 497939 (accession)*
- Experimental design- Randomized Block Design with 3 replications

(Cont….)

(Cont…)

- At R3-R4 stage (28-31 July) 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



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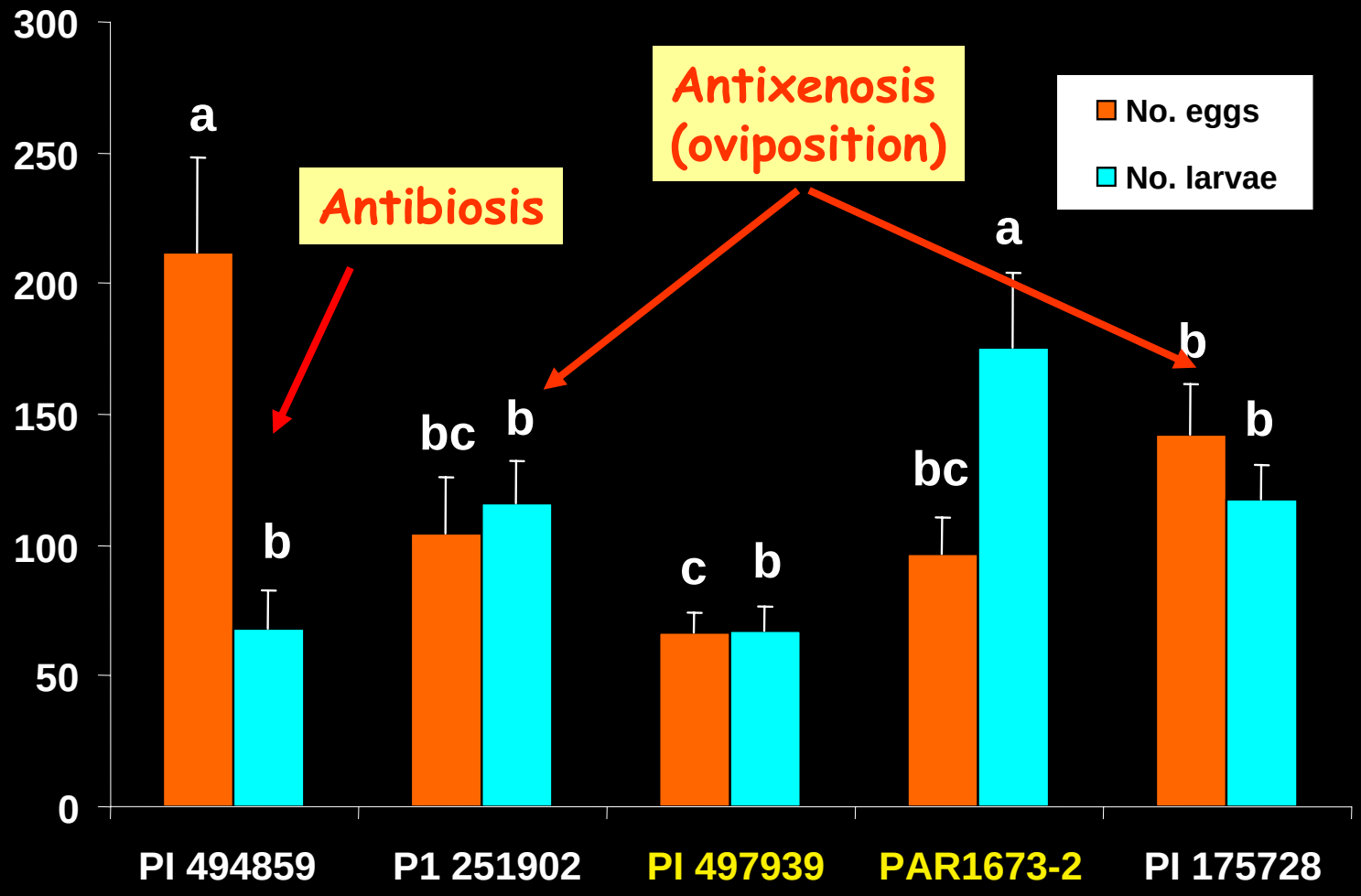
- Bagged heads were harvested (1-2 October) and taken to Fargo for evaluation
- Each head was evaluated for total number of larvae, damaged seed, and total number of seed
- A minimum of 30 larvae from each head were dissected for the presence and absence of parasites

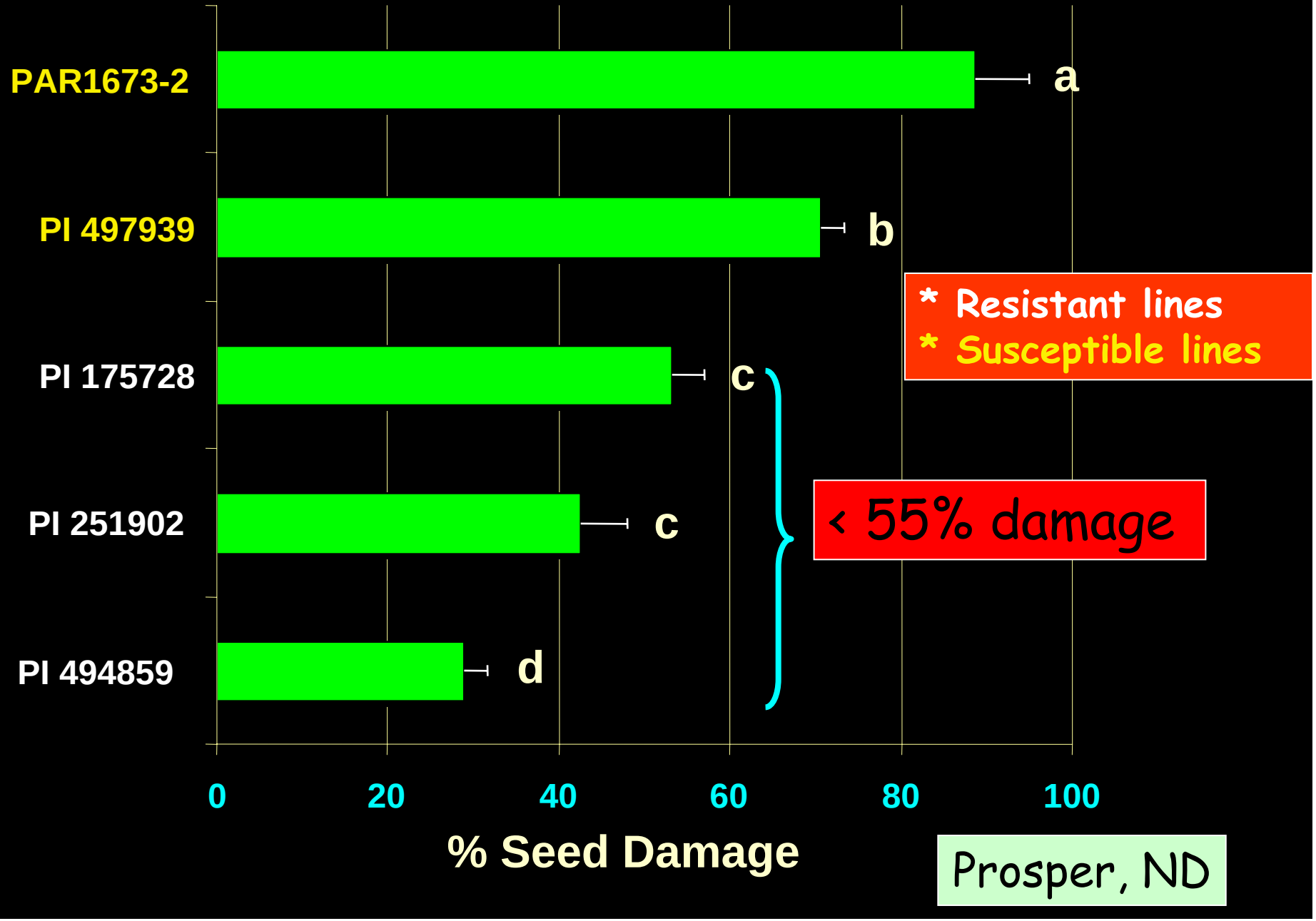
Resistance Mechanisms Study-2008



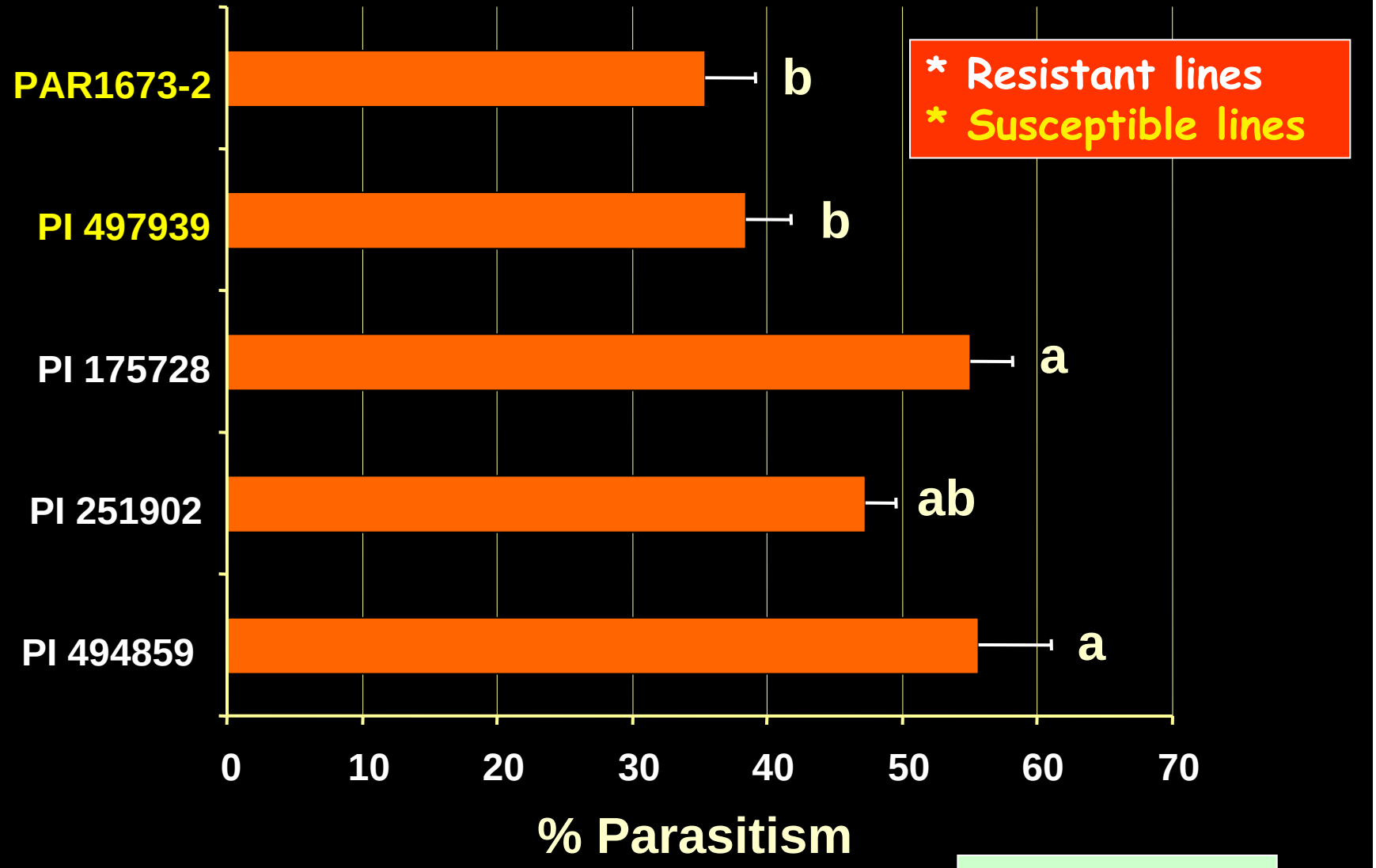
* Resistant lines
* Susceptible lines

Prosper, ND

Resistance Mechanisms Study-2008



Resistance Mechanisms Study-2008



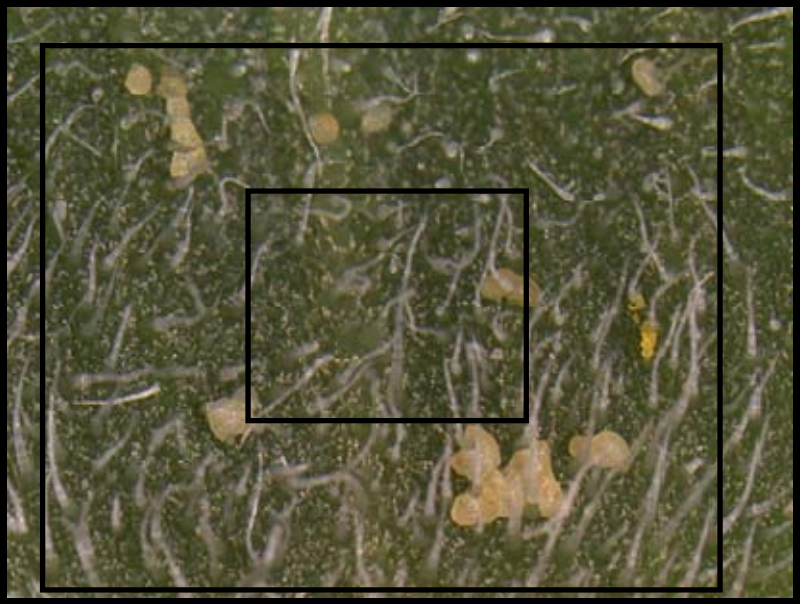
Prosper, ND

Results

- Resistant accession PI 494859 had significantly higher egg counts compared to other resistant and susceptible lines, but had lower larval numbers and lowest seed damage - Resistance mechanism could be antibiosis
- Resistant accessions PI 251902 and PI 175728 had significantly lower egg counts than accession PI 494859 – could be antixenosis

Trichome density *Vs* oviposition

Banded sunflower moth prefers to lay eggs on the outer surface of the bracts at the base of the hairs



Conducted a preliminary study on comparing the hair density in susceptible and resistant sunflower lines

Trichome density *Vs* Susceptibility to BSM

Resistant

Sunflower Line	No. Bracts	No. hairs/cm² Mean ± s.e.m.
06-848	10	53.4 ± 5.1
06-849	5	21.8 ± 5.5
06-850	15	45.9 ± 4
06-851	20	41.1 ± 3.8
06-852	10	40.2 ± 5.8
06-853	10	10.4 ± 3.03
06-872	15	52.7 ± 6.4
06-873	30	51.4 ± 4.2
06-874	5	92 ± 10.5
06-875	5	93.8 ± 8
06-876	5	50.8 ± 6.7
06-877	10	47.9 ± 8.3
06-896	15	50.8 ± 6.7
06-898	10	59.8 ± 4.8
06-897	5	40.2 ± 11.1
06-899	5	26.8 ± 8.5
06-900	5	46.2 ± 4.6
06-901	15	80.5 ± 13.4

Susceptible

Sunflower Line	No. Bracts	No. hairs/cm² Mean ± s.e.m.
HA-445	5	87.4 ± 9.4
HA-456	4	88.5 ± 23.7
HA-458	5	186.2 ± 8.1
HA 466	5	103 ± 11.3
HA-467	5	110.2 ± 6.5

Resistant < 60 hairs/cm²
(except highlighted)
Susceptible- 87-186 hairs/cm²

*Suggests that higher the hair density higher is susceptiblity to BSM

Future Directions

- Screening more sunflower germplasm for resistance
- Conducting detailed investigations on antibiosis and antixenosis effects of host-plant (trichome density *vs* ovipositional preference)

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Thank You


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