Progress in selection for resistance to head-infesting sunflower insects

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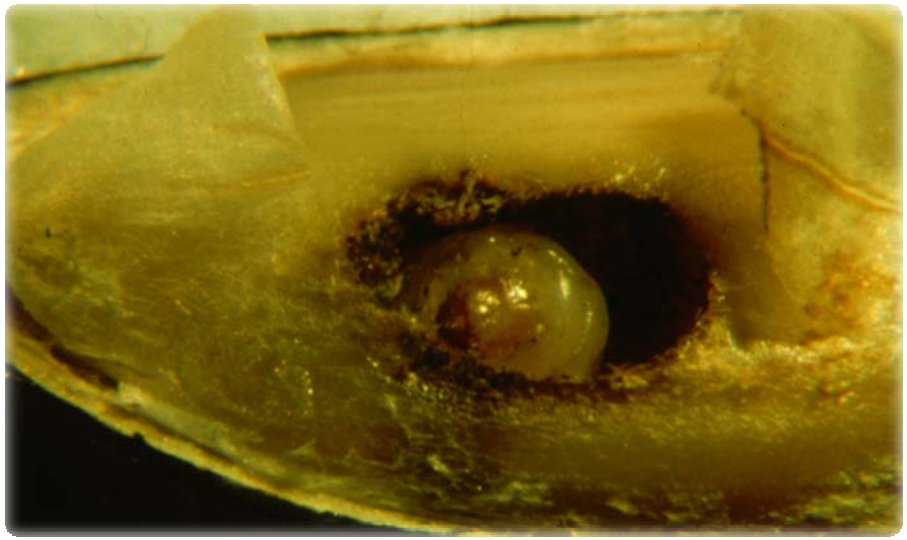
Sunflower Head Insects



Insect Resistance Program - Approach

- **Exploit natural defenses in *Helianthus***
  - **Antibiosis – negative effect on pest development**
  - **Antixenosis – unattractiveness to pest**
  - **Tolerance – ability to yield despite pest injury**
  - **General or specific (antibiosis versus 'toxin X')**

- **In-field screening of sunflower germplasm**
  - ***H. annuus* accessions (PIs)**
  - **Interspecific hybrids, commercial hybrids**

Insect Resistance Program - Review

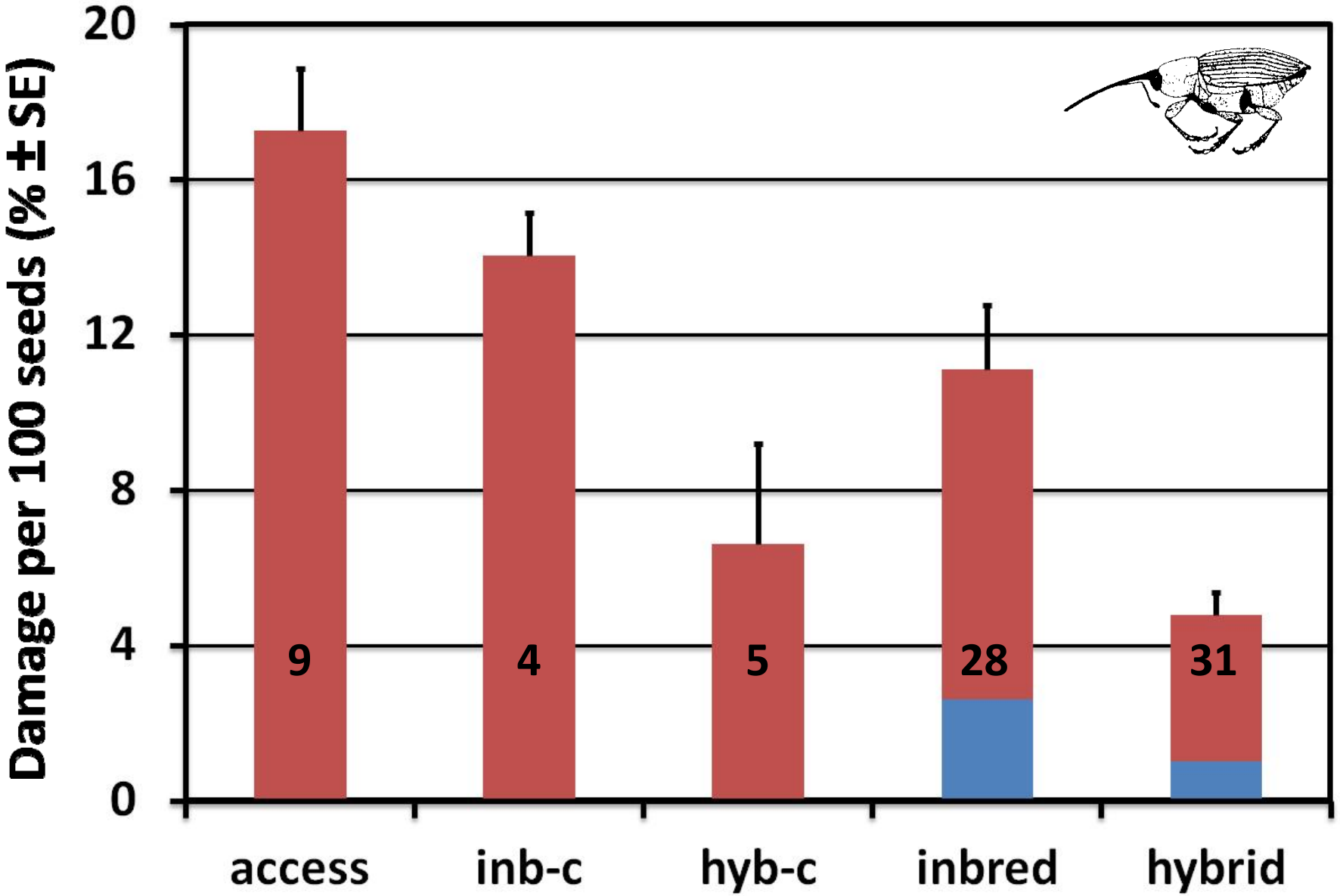
- **Plots in North Dakota, Kansas, South Dakota**
  - **Basic screening 1999 – 2008**
  - **Inbreds and hybrids 2008 – present**

- **Mechanisms of resistance?**
  - **RSSW: Evidence of multiple, but no specifics**
  - **SM: Physical (achene), chemical (florets)**
  - **BSM: Evidence of antibiosis, antixenosis**

Insect Resistance Program - Review

- **Red sunflower seed weevil**
  - **PI 431542 (F7), PI 431545 (F4)**
- **Sunflower moth**
  - **STR 1622-2 (F7), PI 170415 (F4)**
- **Banded sunflower moth**
  - **PRA 1142 (F7), PI 494859 (F4)**
- **Sunflower stem weevil**
  - **HIR 828-2 (F7), PI 386230 (F4), PI 650558 (F5)**

Red Sunflower Seed Weevil – PI 431542



Red Sunflower Seed Weevil – PI 431542

R^2=0.38

HA 441

HA 445

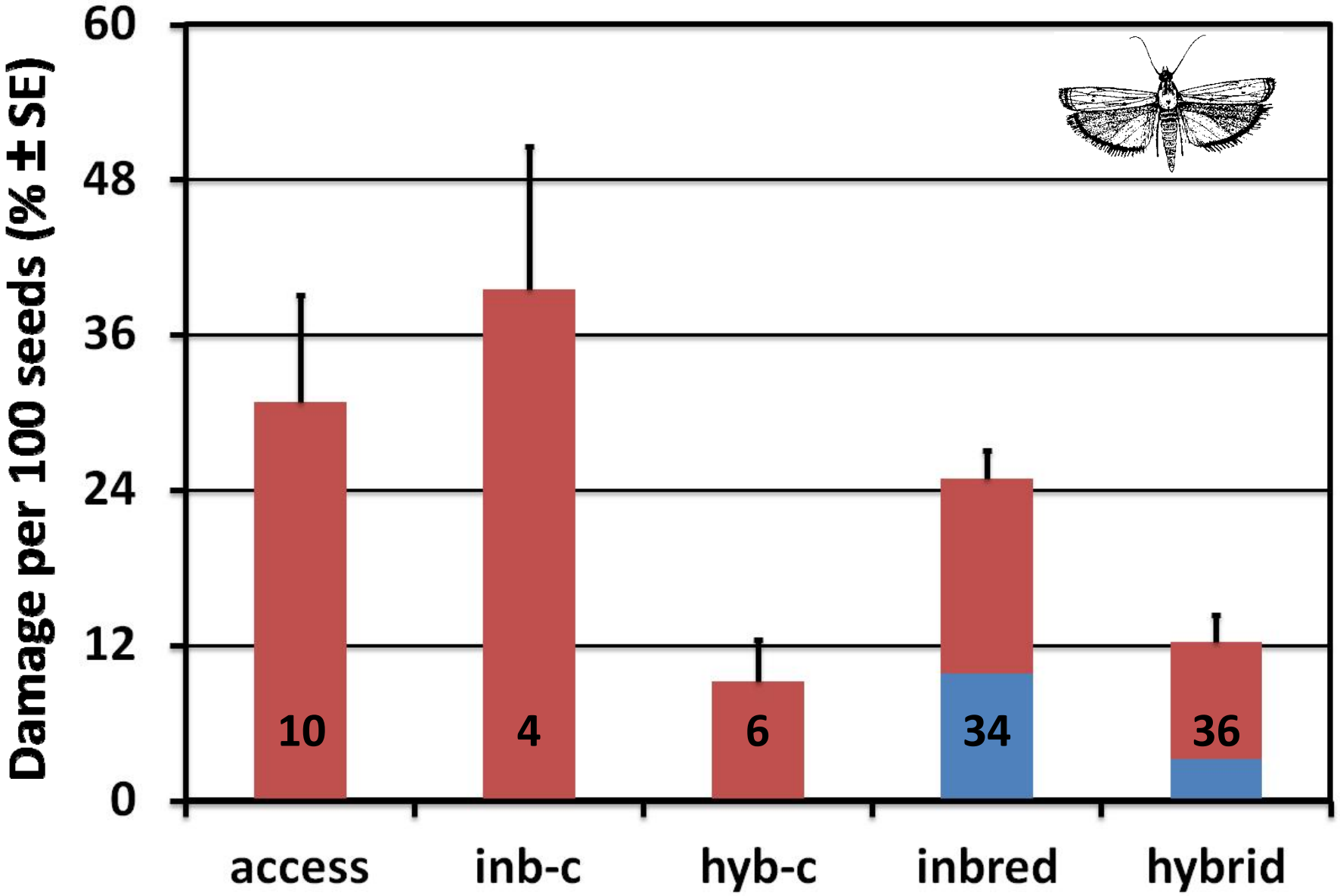
Damage to testcross hybrids (%)

16
12
8
4
0

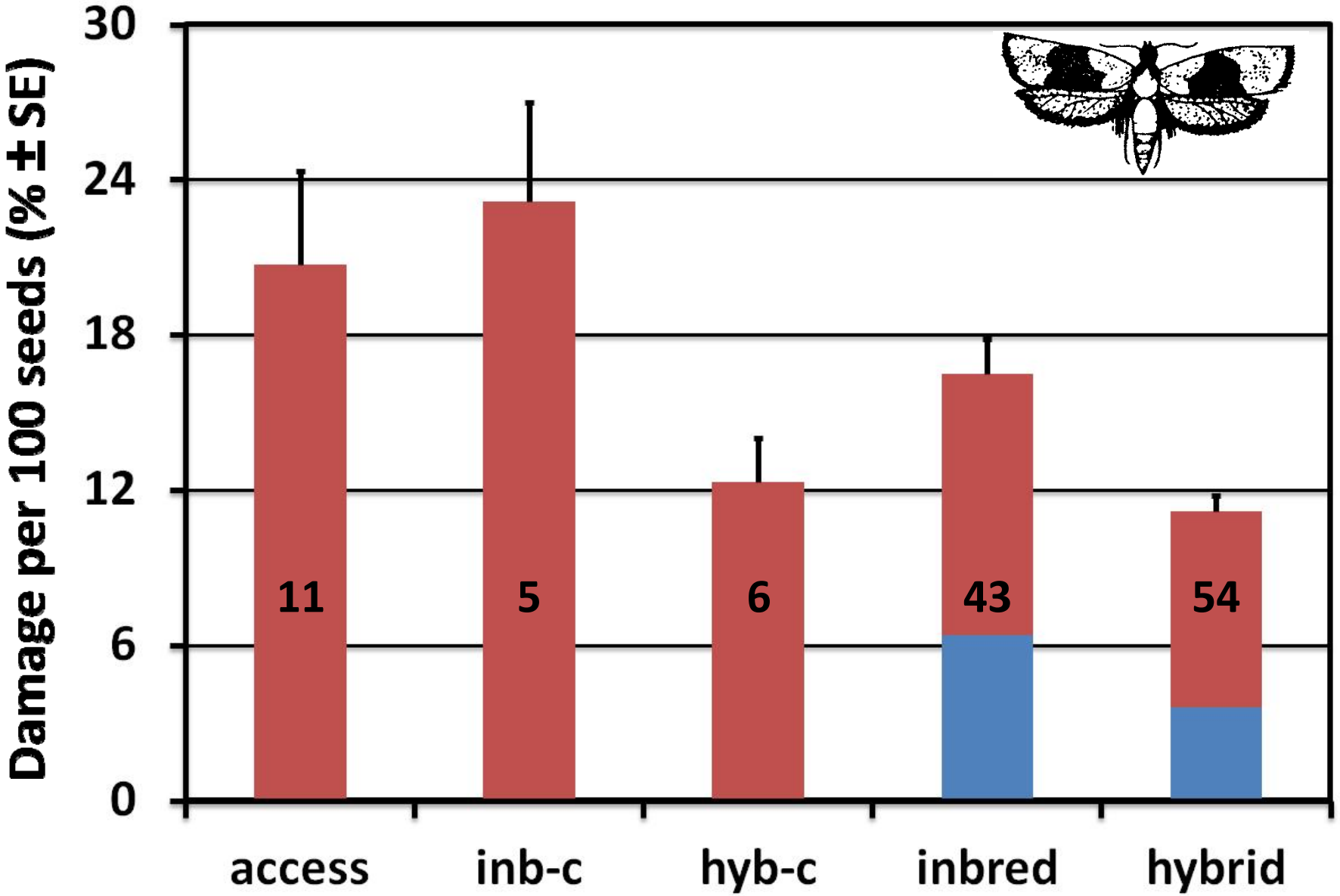
0
10
20
30
40

Damage to inbred population (%)

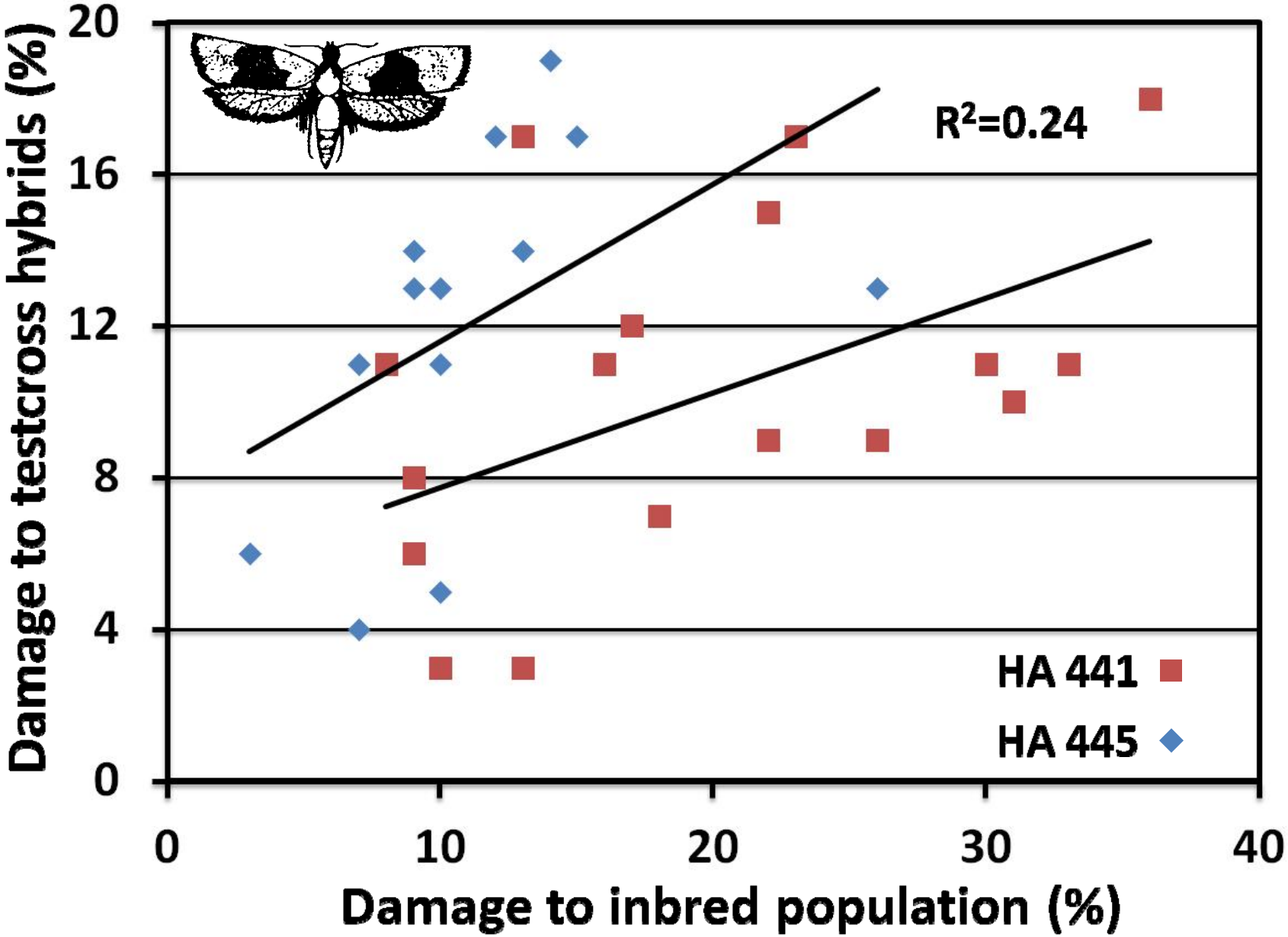
Sunflower Moth – STR 1622-2



Banded Sunflower Moth – PRA 1142



Banded Sunflower Moth – PRA 1142



Resistance Program – Future Directions

- **Continue testing and development**
  - Added resistance in second populations?
- **Look for known traits in populations**
  - E.g., rapid hardening of pericarp (SM)
  - Select to improve, understand inheritance

- **Investigate new mechanisms**
  - Weevils: insensitive to moth traits

Acknowledgements

- **Larry Charlet**

  Service to program
  Insect photos & illustrations

- **National Sunflower Association**

  Funding for insect resistance research

- **Technical support and student help**

  Scoring thousands of samples each year

Resistance Program – Future Directions

- **Floret glandular trichomes**
  - **Applied to diet and dried**
  - **SM growth -80% at 11 d**

- **Show value of resistance**
  - **With, without insecticides**
  - ***Rag* in soybean, widely used but most growers unaware**