# Phenotypic diversity of *Puccinia helianthi* (rust) in the sunflower seed production region of California

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# Sunflower Seed in California

- In 2014, California grew approximately ¼ of the world's supply of hybrid sunflower seed.
- California produces approximately 95% of the hybrid seed planted in USA.
- California grows less than 2% of US sunflower acreage.

(Photo: Brandt Berghuis)

(Lazicki, P. and Geisseler, E. 2016)

# Sunflower Hybrid Seed Production in California

- The Sacramento valley in California is known around the world as a premier sunflower producing region.
- Colusa, Solano, Glenn, Sutter, and Yolo.
- Mediterranean climate and field isolation for seed purity.
- Climate helps meet the needs of phytosanitary restrictions for exports.

(Photo: Brandt Berghuis)

(Long, R. et al 2019)

# Sunflower Seed Production California

- California's dry climate and irrigated sunflower fields, disease prevalence and severity is less than some other production areas in the USA.
- However, many pathogens are classified under quarantine status and thus can impede exportation.


(Photo: Brandt Berghuis)

(Long, R. et al 2019)

# Previous Research

- 15 year study conducted by Gulya et al 2012 found three quarantine type diseases on sunflower breeding fields (rust most prevalent 4.3% of production fields).
- Previous research on the diversity of *P. helianthi* in the United States showed that across 104 locations in the United States 29 races were determined (Friskop et al 2015).
- This study only included 7 field locations in California.

(Photo: Brandt Berghuis)

# Previous Research

- Isolates from California generally appeared to be more virulent.
- Most cultivated sunflowers in California have a diverse number of host genotypes.
- Virulence data in California could provide useful phenotypic information for production fields in the Midwest.

(Friskop et al 2015)

# Objective

Determine the phenotypic diversity of *Puccinia helianthi* (rust) in the sunflower seed production region of California

# Pathogen Collections

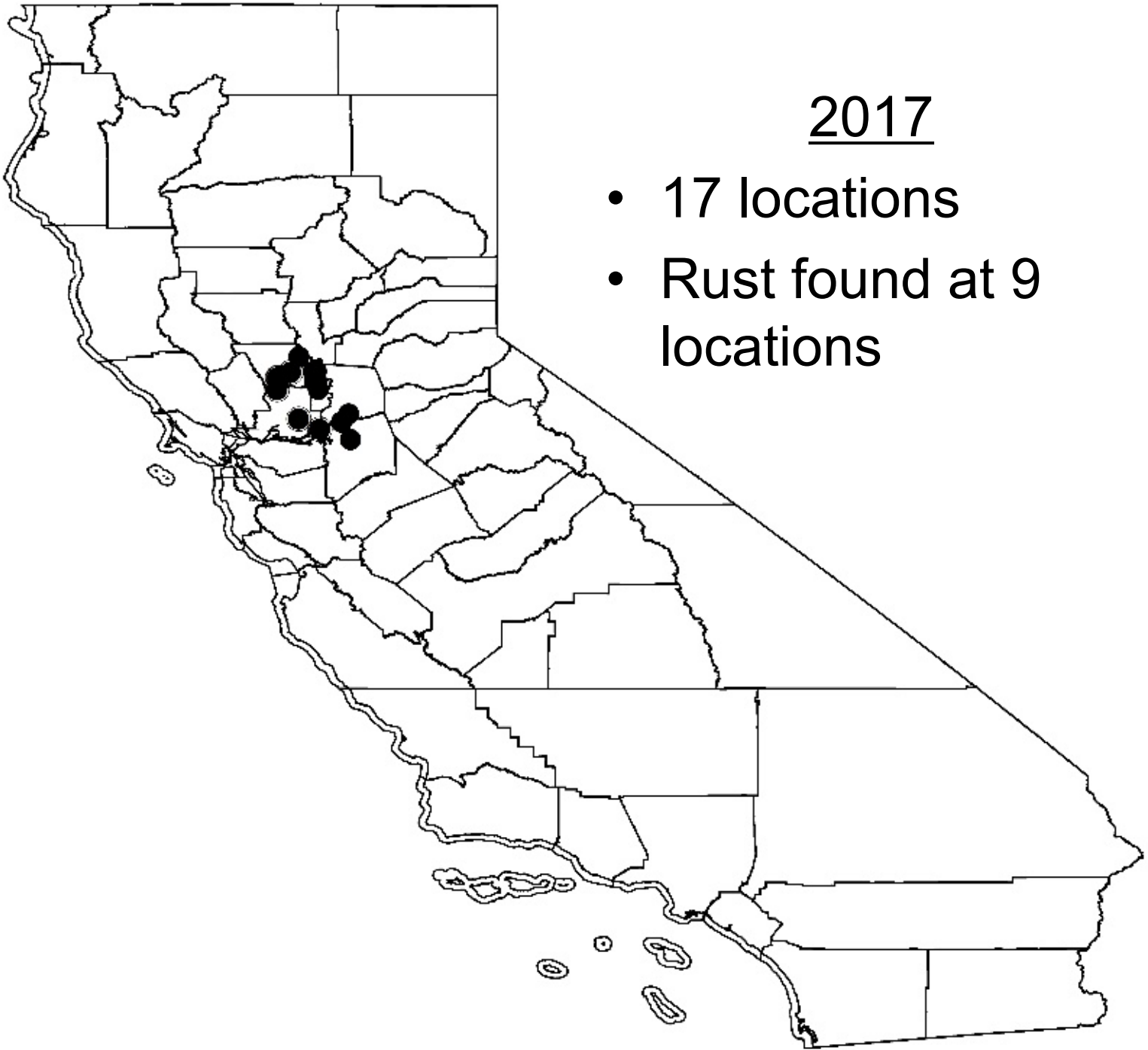
I. 2017 and 2018 surveys in California.
II. 2017 and 2018 rust from breeders fields in California.
III. 2018 rust samples from North Dakota.
IV. 2018 rust samples from Tom Gulya.

# Excellent Help in California

- Tom Gulya and Ryan Humann
- Tom Heaton and Bill Vaccaro
- Suzanne Rooney Latham and Cheryl Blomquist

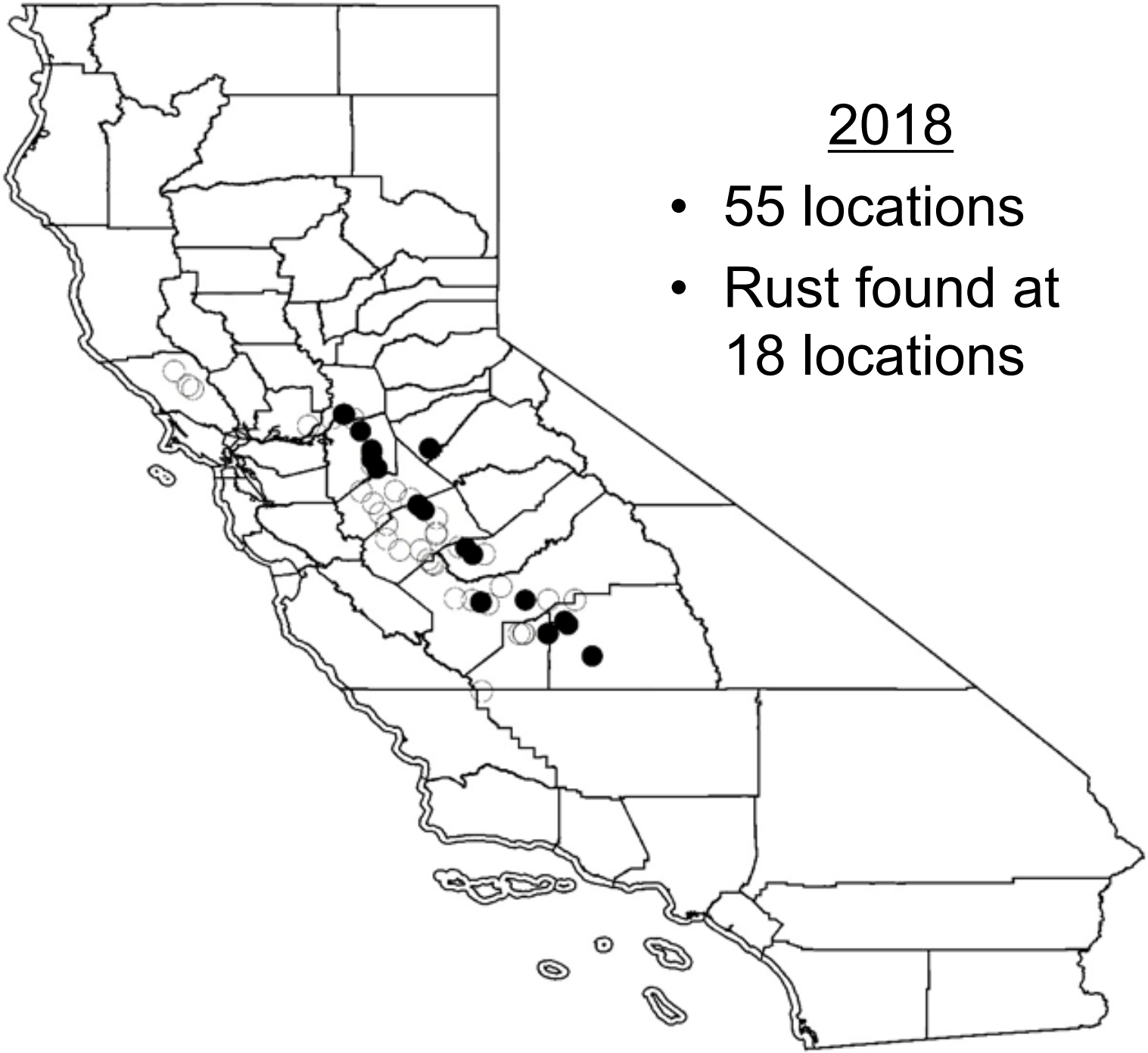

VIVUS


CALL
BOX



## 2017

- 17 locations
- Rust found at 9 locations



## 2018

- 55 locations
- Rust found at 18 locations

# Quick Survey in North Dakota

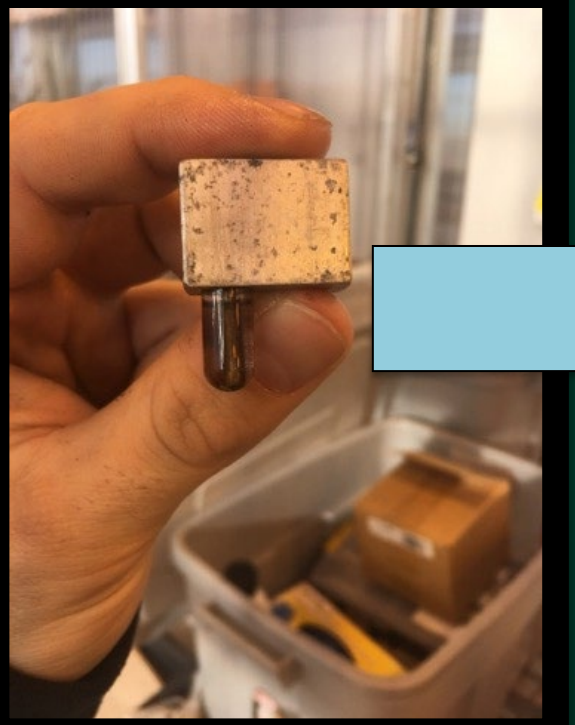

#10
lat 37.3918
long -120.6224


4


PRESSURE
VACUUM


DEWALT
SAM

# Inoculating Differentials



(Photo: Brandt Berghuis)

**Table 1.** Sunflower rust differential line, resistance genes or alleles, and scoring values for race nomenclature

| Set | Differential | Resistance gene or alleles | Scoring value[a] |
|---|---|---|---|
| One | 7350 | … | 1 |
| | MC90 | $R_1$ | 2 |
| | MC29 | $R_2 + R_{10}$ | 4 |
| Two | P386 | $R_{4e}$ | 1 |
| | HA-R1 | $R_{4a}$ | 2 |
| | HA-R2 | $R_5$ | 4 |
| Three | HA-R3 | $R_{4b}$ | 1 |
| | HA-R4 | $R_{4c}$ | 2 |
| | HA-R5 | $R_{4d}$ | 4 |

[a] Scoring value is the numerical value associated with virulence on a specific differential. The additive score for each set is the digit in the three-digit race name (Gulya and Masirevic 1996).

(Friskop et al. 2015)

# Production Fields Sunflower Rust Races 2017-18

- 2017
  - 11 isolates
  - 6 races
  - 337 most prevalent (4/11)
  - Solano and Glenn
- 2018
  - 13 isolates
  - 8 races
  - 336 most prevalent (5/13)
  - Solano and Glenn

# Wild Sunflower Rust Races 2017-18

- 2017
  - 11 isolates
  - 6 races
  - 337 most prevalent
- 2018
  - 20 isolates
  - 16 races
  - 336 most prevalent

# Field Samples-Rust Races 2018 in North Dakota

- 2018
  - 3 rust races
  - (325, 326, and 336)

(Photo: Brandt Berghuis)

# Most Effective Genes/Alleles

| 7350 | MC90 | MC29 | P386 | HA-R1 | HA-R2 | HA-R3 | HA-R4 | HA-R5 |
|---|---|---|---|---|---|---|---|---|
| … | $R_1$ | $R_2$+$R_{10}$ | $R_{4e}$ | $R_{4a}$ | $R_5$ | $R_{4b}$ | $R_{4c}$ | $R_{4d}$ |
| 0/50 | 4/50 | 36/50 | 11/50 | 8/50 | 49/50 | 29/50 | 14/50 | 13/50 |

# Most Effective Genes/Alleles

| 7350 | MC90 | MC29 | P386 | HA-R1 | HA-R2 | HA-R3 | HA-R4 | HA-R5 |
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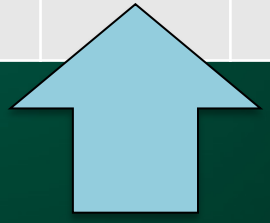
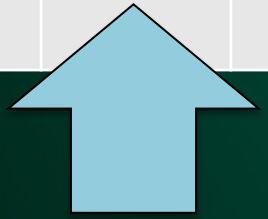
| 0/50 | 4/50 | 36/50 | 11/50 | 8/50 | 49/50 | 29/50 | 14/50 | 13/50 |



HA-R2 was resistant to 49/50 isolates

# Most Effective Genes/Alleles

| 7350 | MC90 | MC29 | P386 | HA-R1 | HA-R2 | HA-R3 | HA-R4 | HA-R5 |
|---|---|---|---|---|---|---|---|---|
| … | $R_1$ | $R_2$+$R_{10}$ | $R_{4e}$ | $R_{4a}$ | $R_5$ | $R_{4b}$ | $R_{4c}$ | $R_{4d}$ |
| 0/50 | 4/50 | 36/50 | 11/50 | 8/50 | 49/50 | 29/50 | 14/50 | 13/50 |



MC90 was resistant to 4/50 isolates

# Summary

- Our findings were similar to what Friskop et al. 2015 found.
- Did not find a lot of differences in races of rust on wild sunflower compared to breeding fields.
- One isolate virulent on all resistant genes/alleles in the differential set.

# Thank you!


# Work Cited


- Friskop, A., Gulya, T., Harveson, R., Humann, R., Acevedo, M., and Markell, S. 2015. Phenotypic Diversity of Puccinia helianthi (Sunflower Rust) in the United States from 2011 and 2012. Department of Plant Pathology, North Dakota State University, Fargo.
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