Monitoring for the Navel Orangeworm in the Presence of Mating Disruption

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USDA Agricultural Research Service

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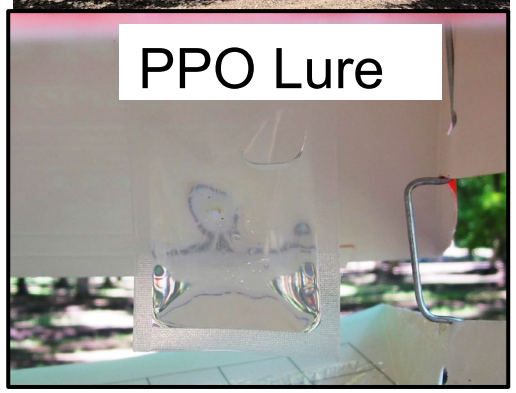
Acknowledging collaborators:
- Brad Higbee
- Joel Siegel
- Jhalendra Rijal
- Houston Wilson
- David Haviland

Monitoring—topics

- The challenge: certainty of data given uncertain mating disruption status
- The environment: which tree nut?
- The objective: timing, or thresholds?
- The approaches
  - Pheromone (standard, mega)
  - Phenyl propionate
  - Ovibait
  - Egg traps
- Summary

Attractants for Monitoring NOW

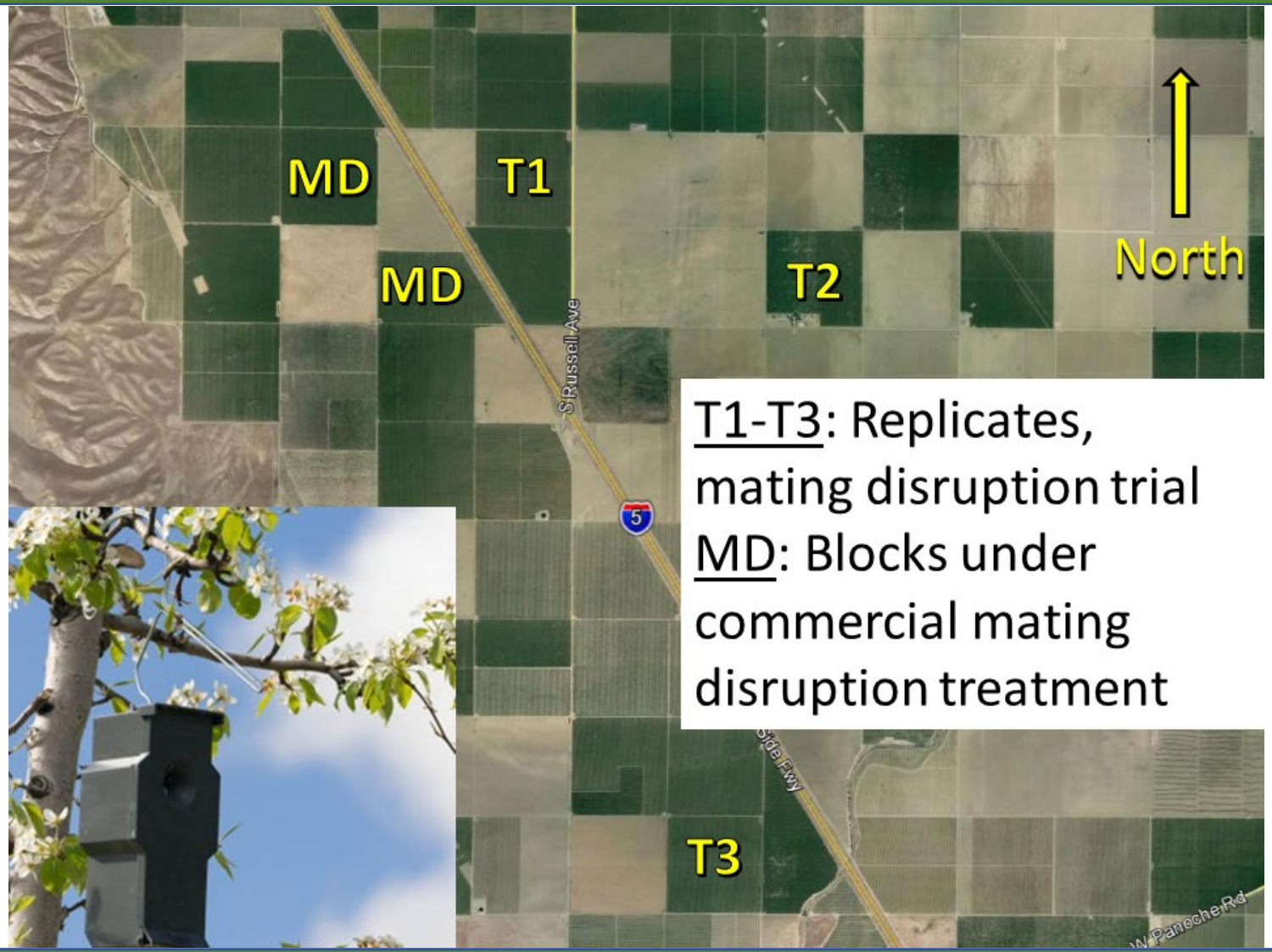
Ovibait (Peterson) Trap



Commercial
PPO Lure

Pheromone
Megalure

Monitoring for NOW in presence of MD



T1-T3: Replicates, mating disruption trial

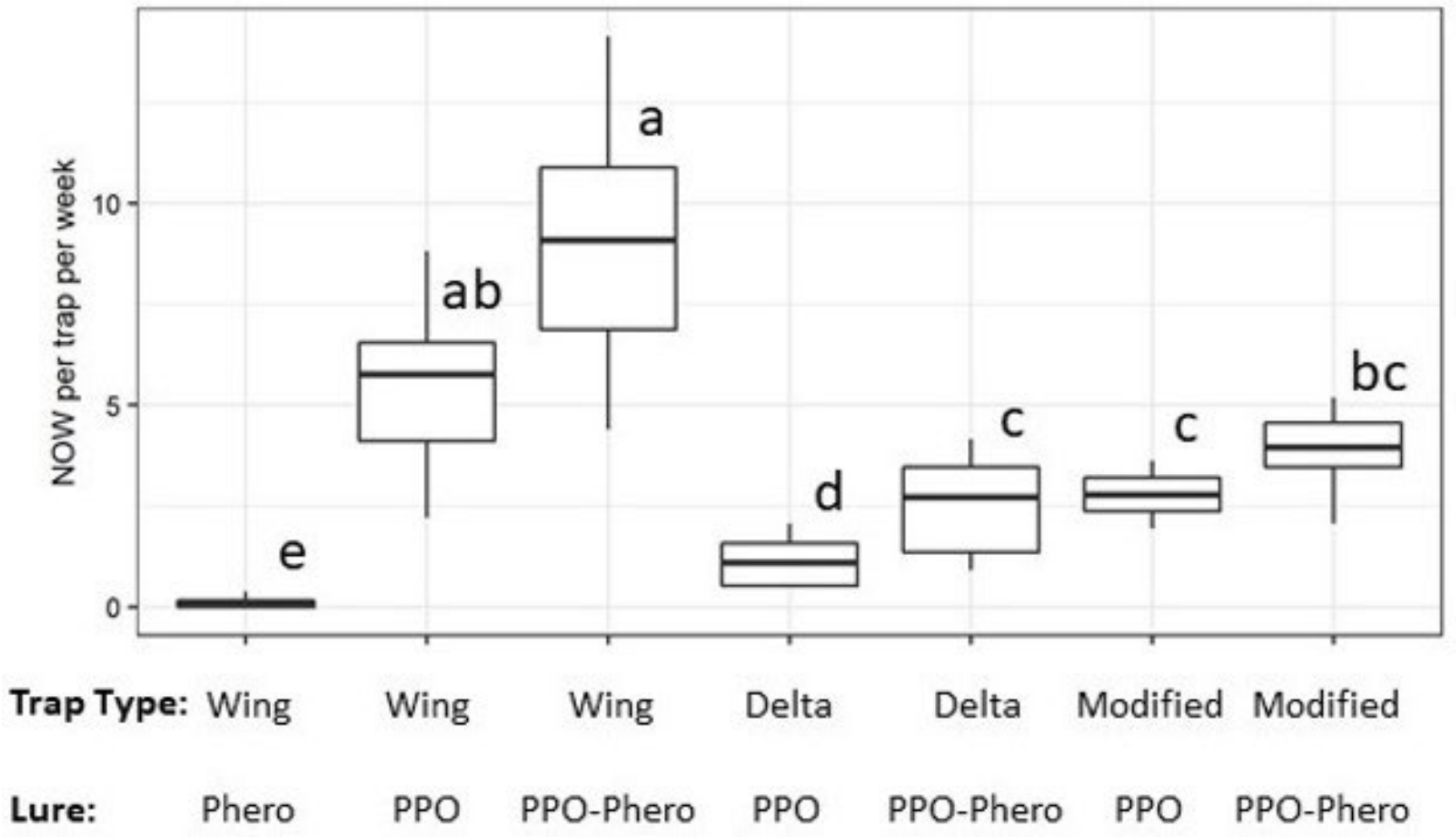
MD: Blocks under commercial mating disruption treatment

PPO: Key points

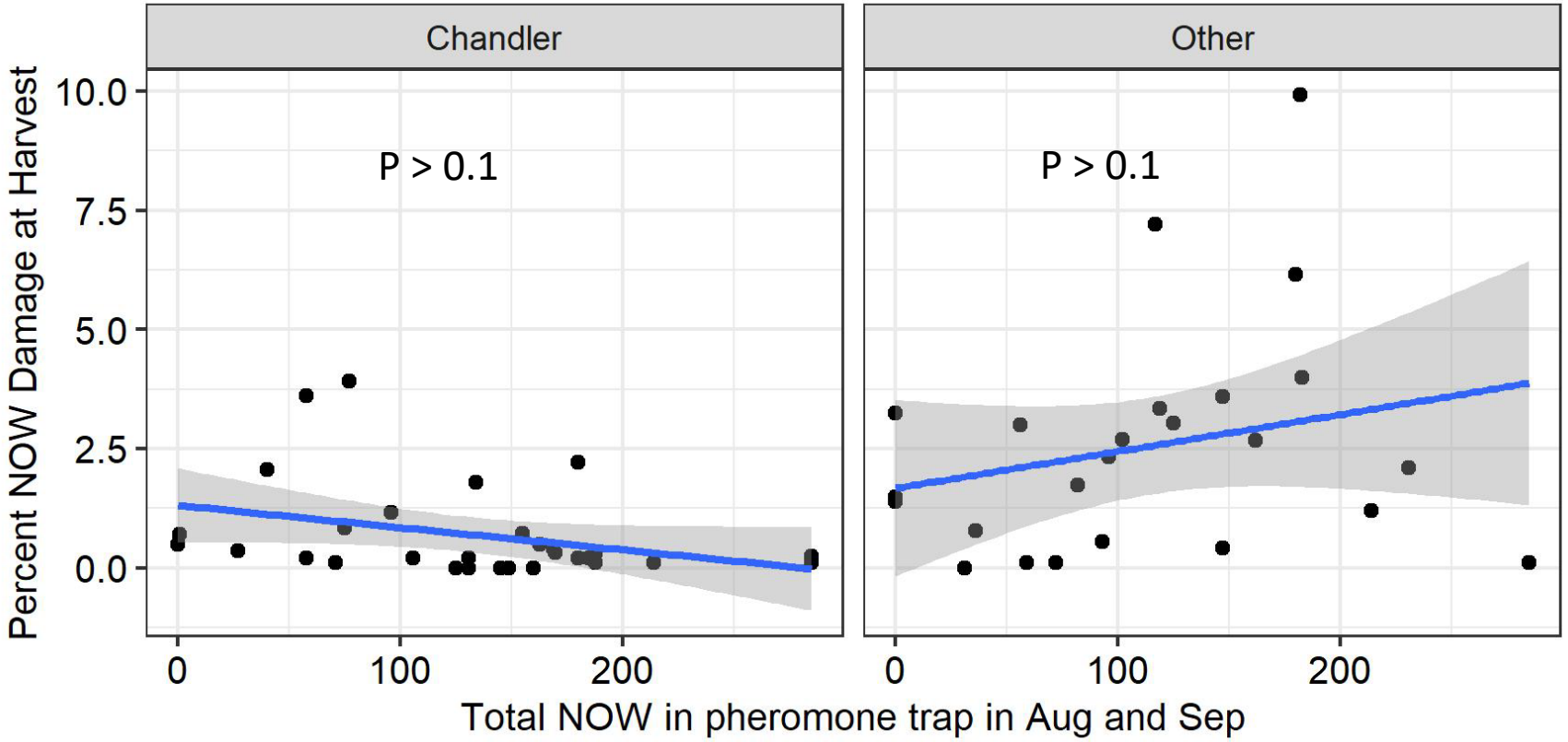
- Captures NOW with or without mating disruption
- Synergized by pheromone
- Captures both males and females
- Possibly correlated with damage

Relative Sensitivity of Trap Types

Relative Sensitivity of trap Types



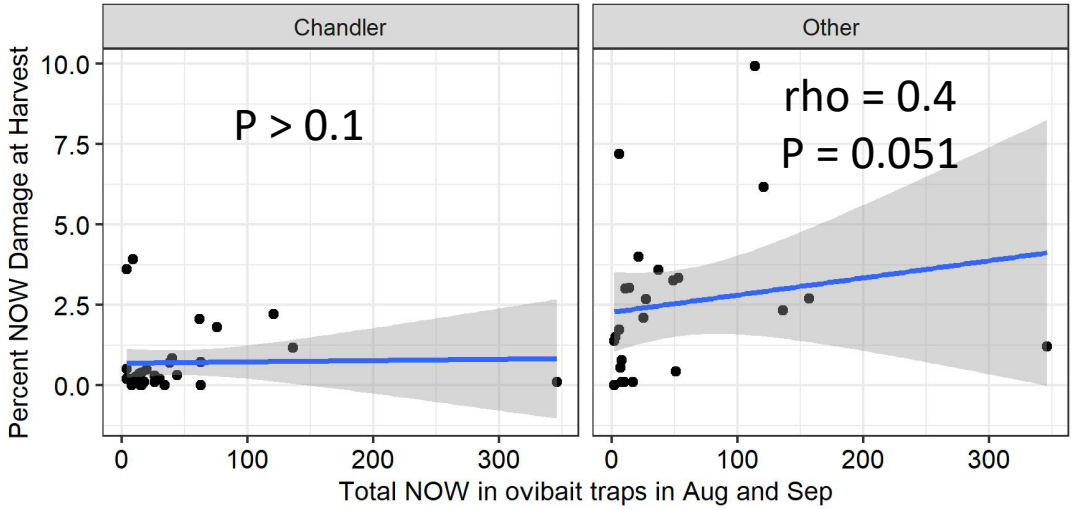
Pheromone traps v. damage in walnuts (3 years)

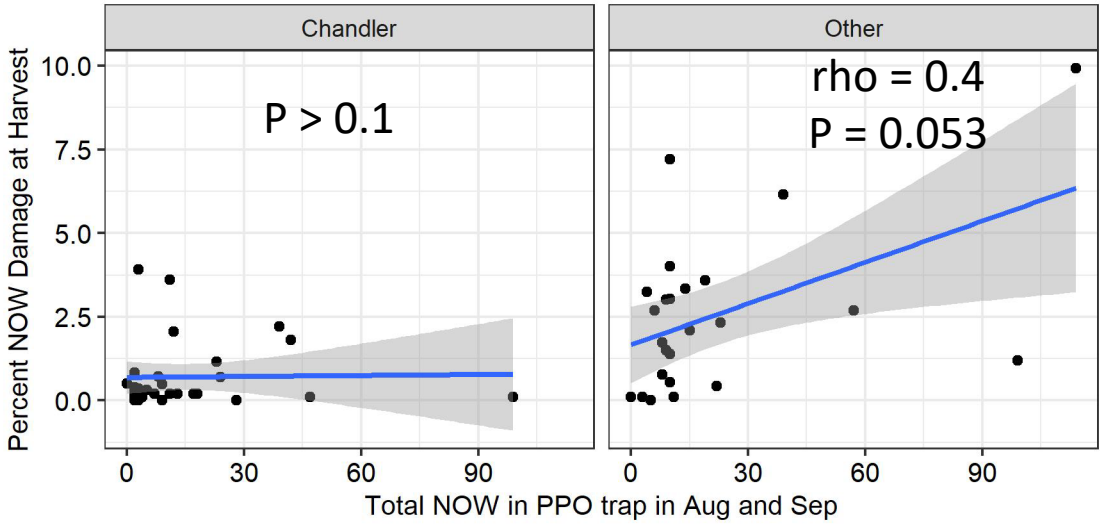


Pheromone trap counts not correlated with damage

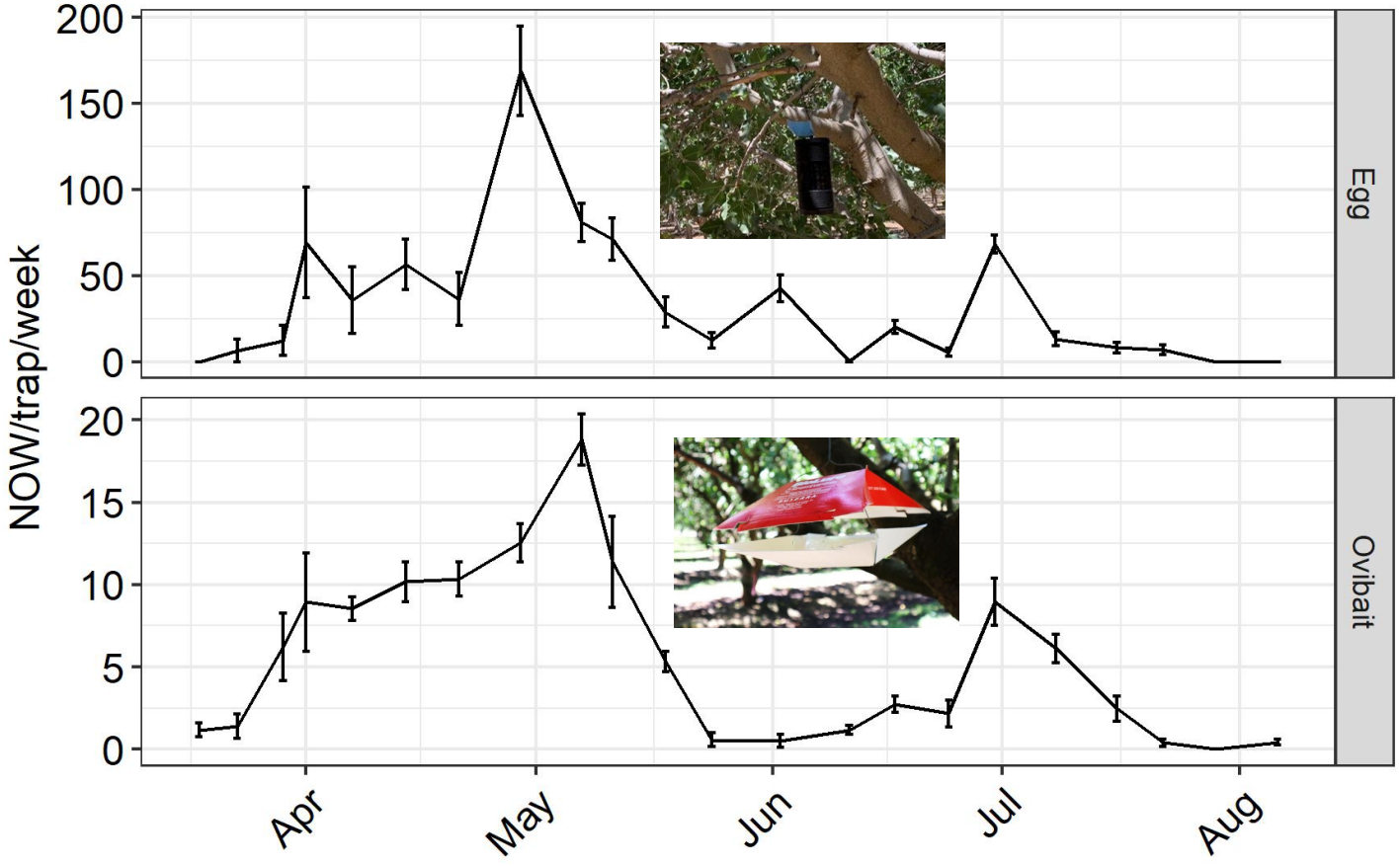
Ovibait and PPO traps v. damage (3 years)

For both attractants, there was marginally significant correlation other varieties, but not in Chandler





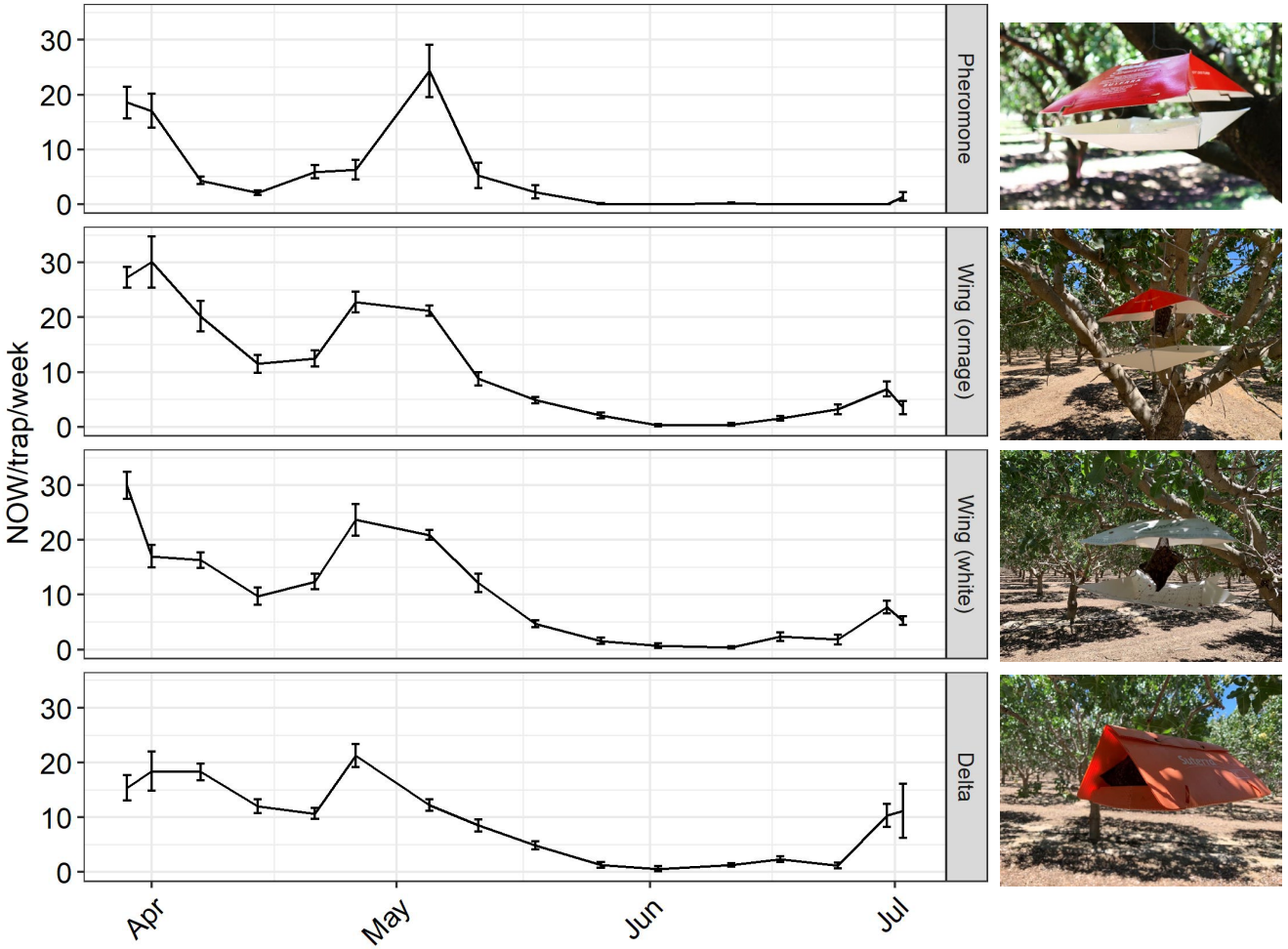
2021: Fresno County pistachios—females vs. eggs



Result

- Similar trap profiles for eggs and females
- (Higher early-season capture of eggs/females in pistachios compared to almonds)

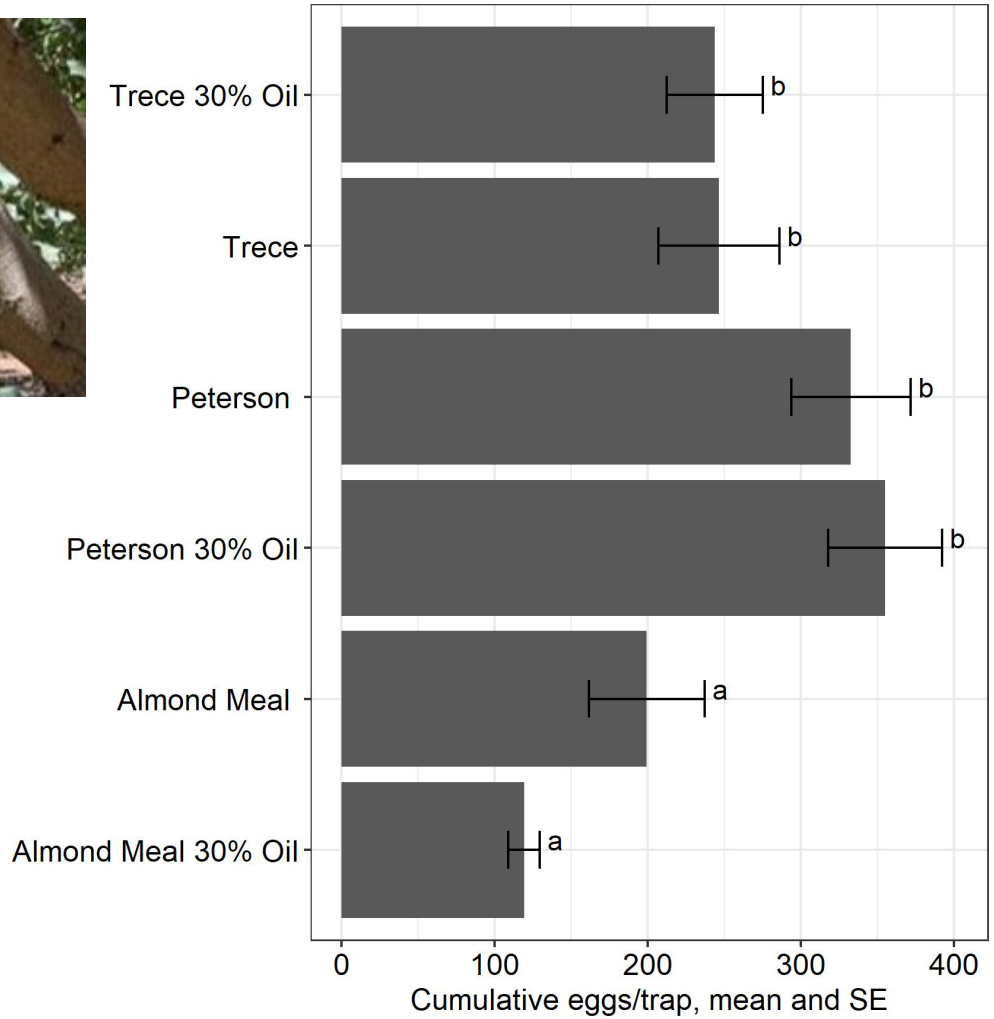
2021: Fresno County pistachios—is trap type important for ovibait effectiveness?



Result

- Little impact of trap design on females in sticky traps
- Trap design less important compared to NOW in pheromone and PPO traps

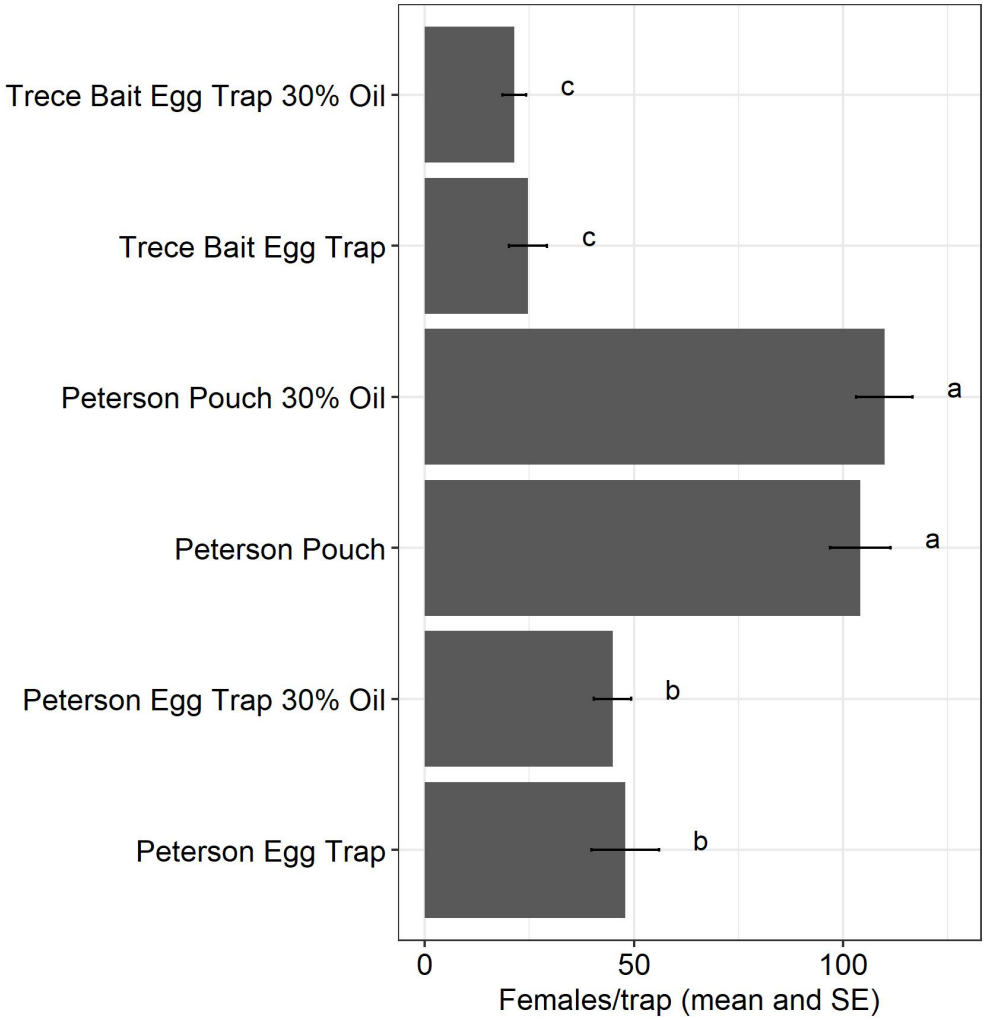
2022: Fresno County pistachios—affect of bait composition on egg trap effectiveness



Preliminary Results

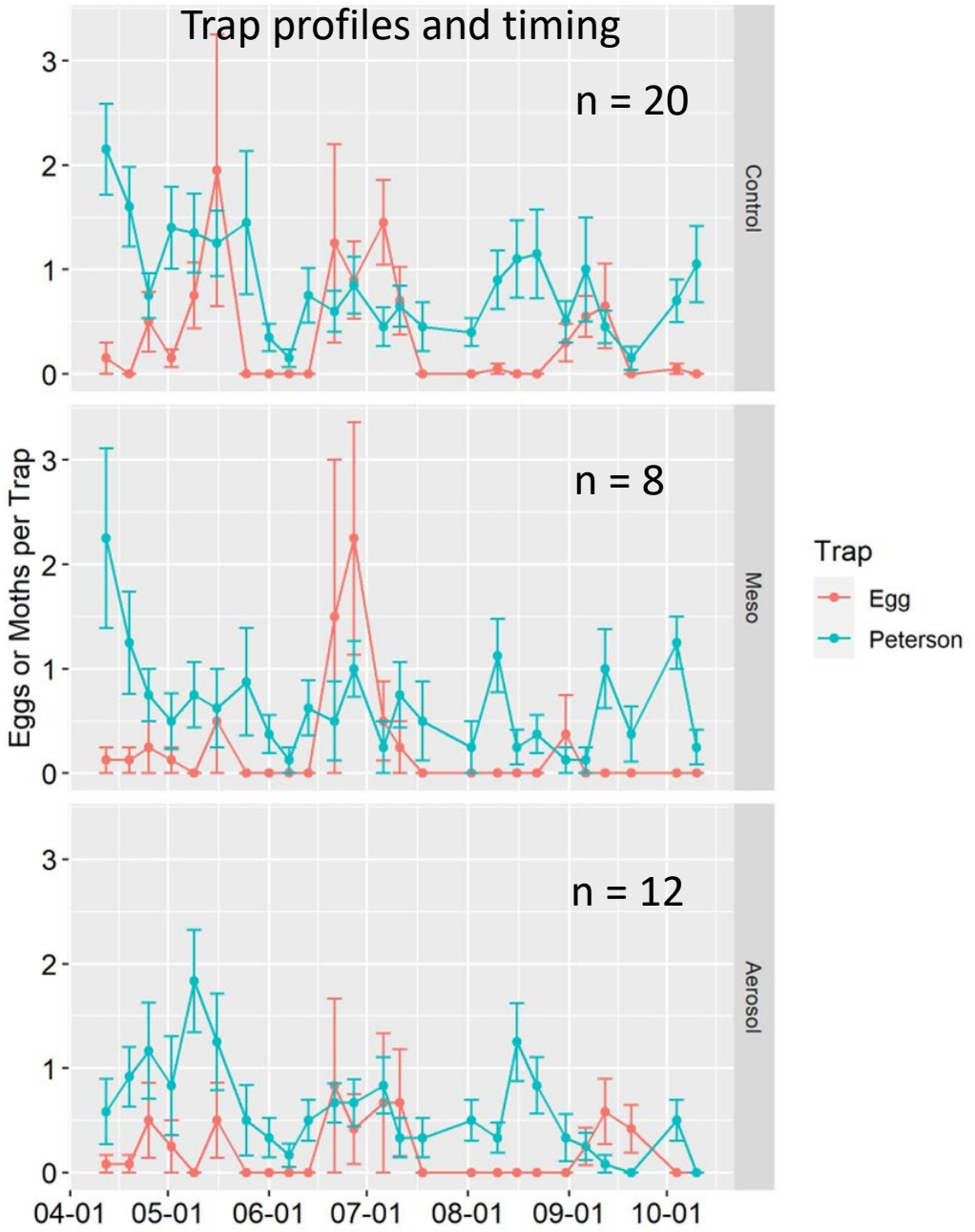
- Peterson bait numerically better than Trece bait
- No apparent effect of oil on egg-laying for Peterson or Trece
- Almond meal not as effective, and oil seems to have greater impact for almond meal

2022: Fresno County pistachios—affect of bait composition on female trap effectiveness



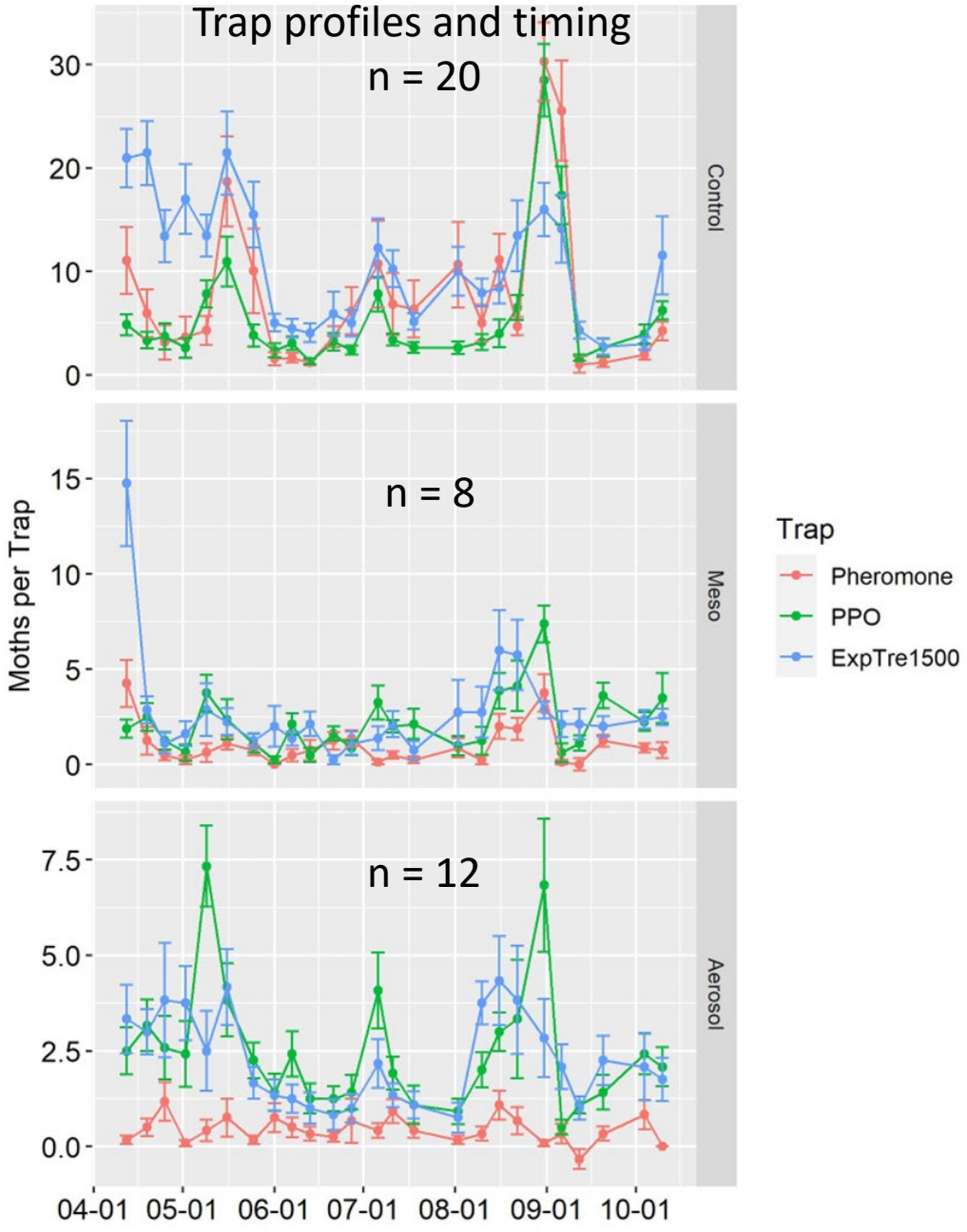
Preliminary Results

- Peterson bait in pouch better than Peterson bait in egg trap
- No apparent effect of oil on egg-laying for Peterson or Trece
- Almond meal not as effective, and oil seems to have greater impact for almond meal



Timing: Eggs vs. females

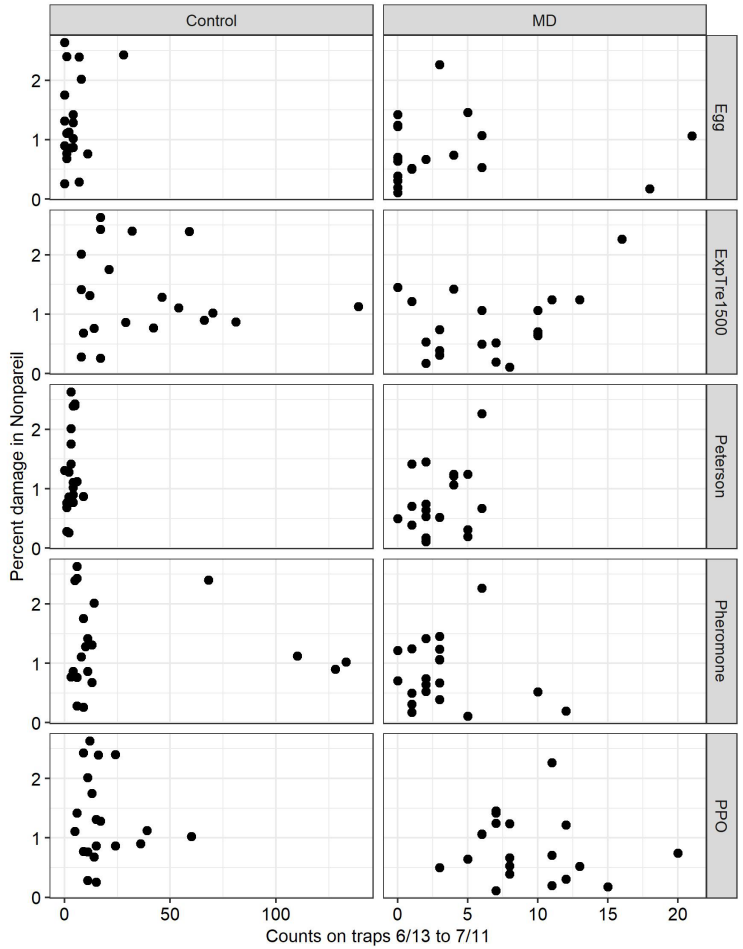
- Captured similar numbers of females and eggs
- Less variability in female than egg traps
- Egg traps zeroed between flights—greater contrast
- Egg trap profiles more variable in flights 3 and 4



Timing: pheromone vs. PPO vs. Experimental

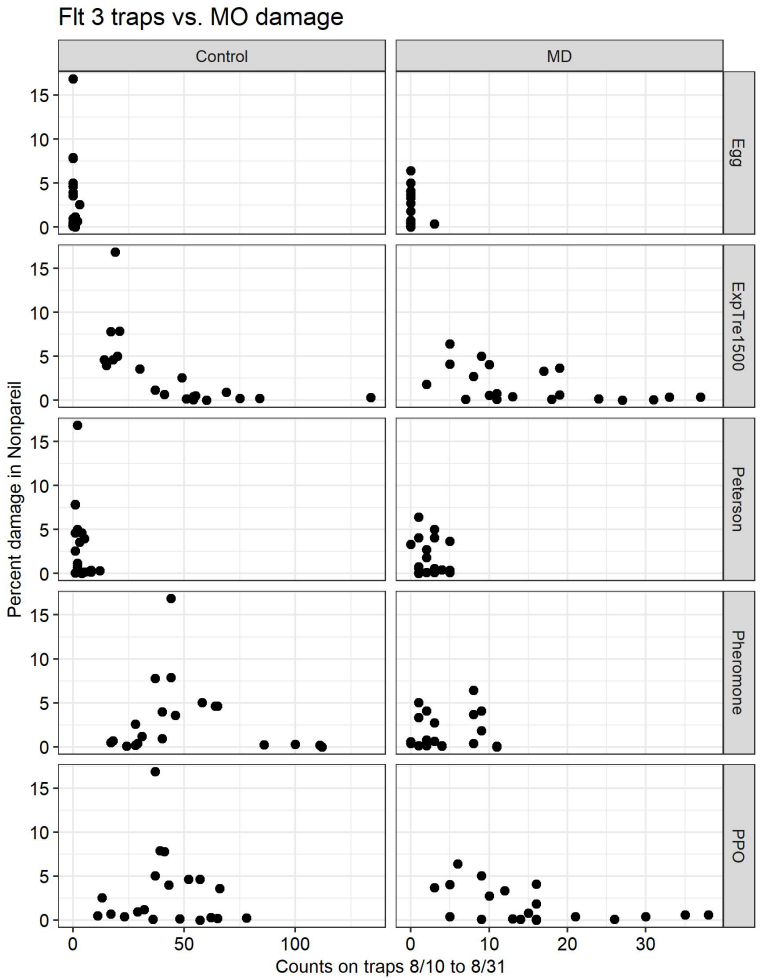
- Pheromone monitoring lure suppressed by mating disruption
- Generally greater capture in MD by PPO-combo than by Experimental
- PPO-combo had later profile in flights 3 and 4

Flight 2 NOW vs. Nonpareil Damage



- Limited damage (<2% windrow, <1% huller)
- Variability in damage results in poor association of samples from individual trees
- Low association in all cases in the control
- In mating disruption, the pheromone mega-lure and the Peterson had better association than other trap type

Flight 3 NOW vs. Monterey Damage



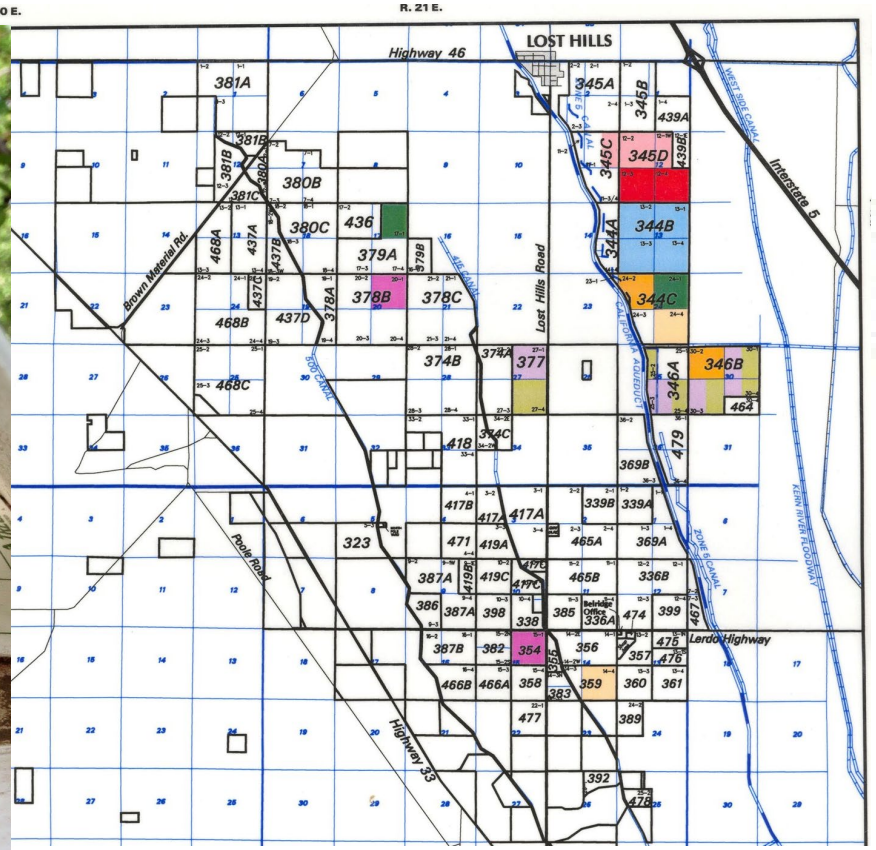
- High damage in Monterey in September did not correlate with Nonpareil damage in August
- By August, female baits (egg, Peterson) were of more limited value
- None of the trap types predicted damage in Monterey
- Mating disruption provided insurance against a blowup of NOW damage

Monitoring Navel Orangeworm in Tree Nuts with or without Mating Disruption

Summary: Attractrants

- Egg traps and sticky traps with female-attractive bait pouches have similar trap profiles
- Crushed pistachios work better than other baits in both egg traps and female bait pouches
- Oil in natural female attractants is of secondary importance
- Little evidence of importance of trap design for female traps, but airflow important
- Female counts more correlated than other attractants with subsequent harvest damage, but…
- Prediction of harvest damage remains a work in progress

Remote automated monitoring: Use cases



Augment labor w/i an organization

Regional information
Public good

Commercial remote automated devices: Semios

- Camera trap
- Part of larger system
- Well established
- Closed, no API
- Currently using ovibait

Commercial remote automated devices: Trapview

- Camera trap
- More sophisticated
- Larger footprint in orchard
- API available

Burks et al. 2022, J. Insect Sci., https://doi.org/10.1093/jisesa/ieac059

Commercial remote automated devices: CropVue

- Camera trap
- More compact
- Working with FMC
- No API, mobile app only

Commercial remote automated devices: FarmSense

- Pseudoaccoustic sensor
- No glue liner
- No image sent
- API available
- Works best with pheromone

Burks 2022, J. Insect Sci., https://doi.org/10.1093/jisesa/ieac059

Thank you…

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