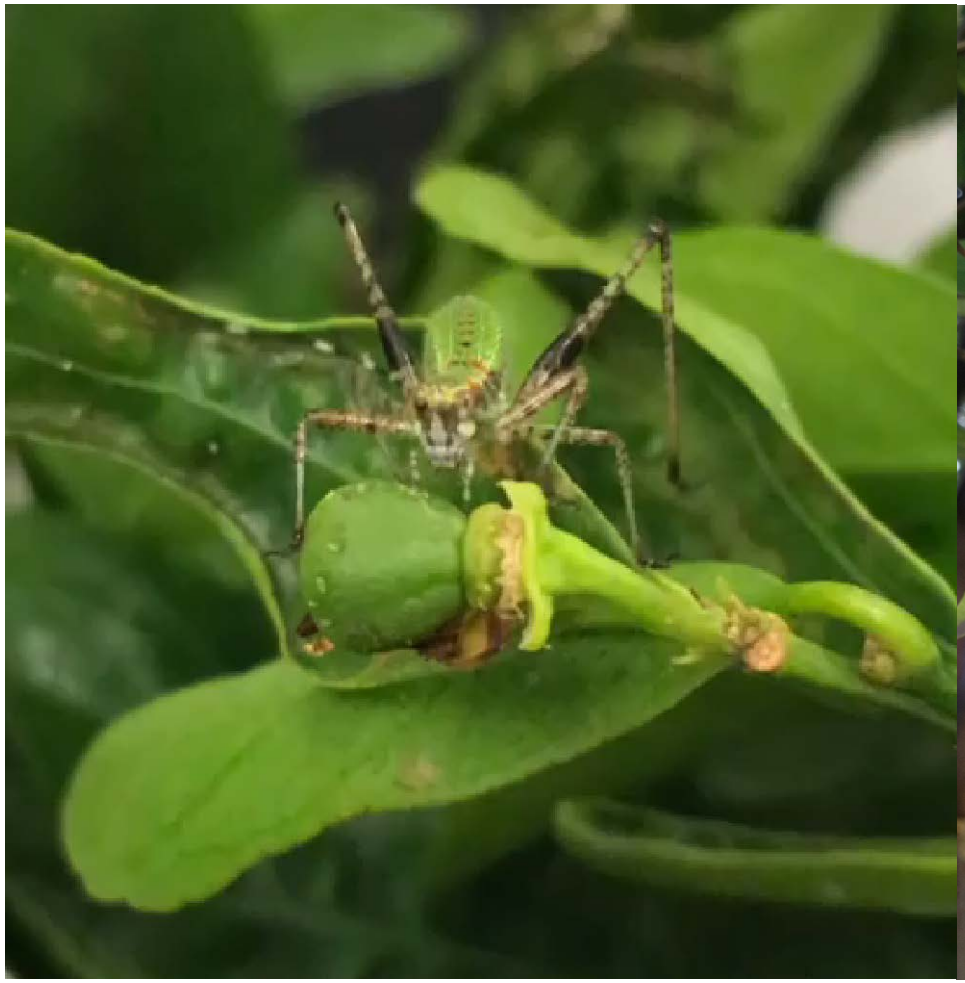
Ecoinformatics and the curious case of katydids in California citrus



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Ecoinformatics

Data mining approach to ecological questions

Data tends to be:

- **observational**
- **pooled from pre-existing sources**
- **plentiful, creating increased statistical power**
- **from broad spatial and temporal scales**
- **from the full range of field conditions**

Complementary to experimental studies

Rosenheim & Gratton (2017) Ann. Rev. Entomol.

Forktailed bush katydid *Scudderia furcata* - Direct pest of citrus in California

The challenge:

- Year-round citrus IPM program established from experiments in navel oranges (*Citrus sinensis*)
- Recent drastic increase in mandarin acreage (*Citrus reticulata, C. clementina*)
- Current guidelines for mandarins have been borrowed from oranges

Do mandarins need different IPM guidelines? If so, how?

Citrus IPM database

Built in collaboration with 11 California citrus growers

Current version contains records for 327 different commercial citrus blocks each surveyed for 1-20 years (~1,800 field-years)

- Field pest density scouting reports
- Fruit scarring evaluations at harvest

?

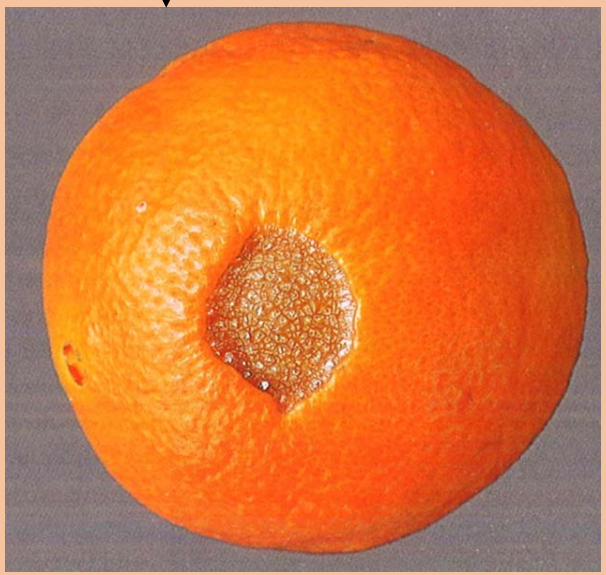
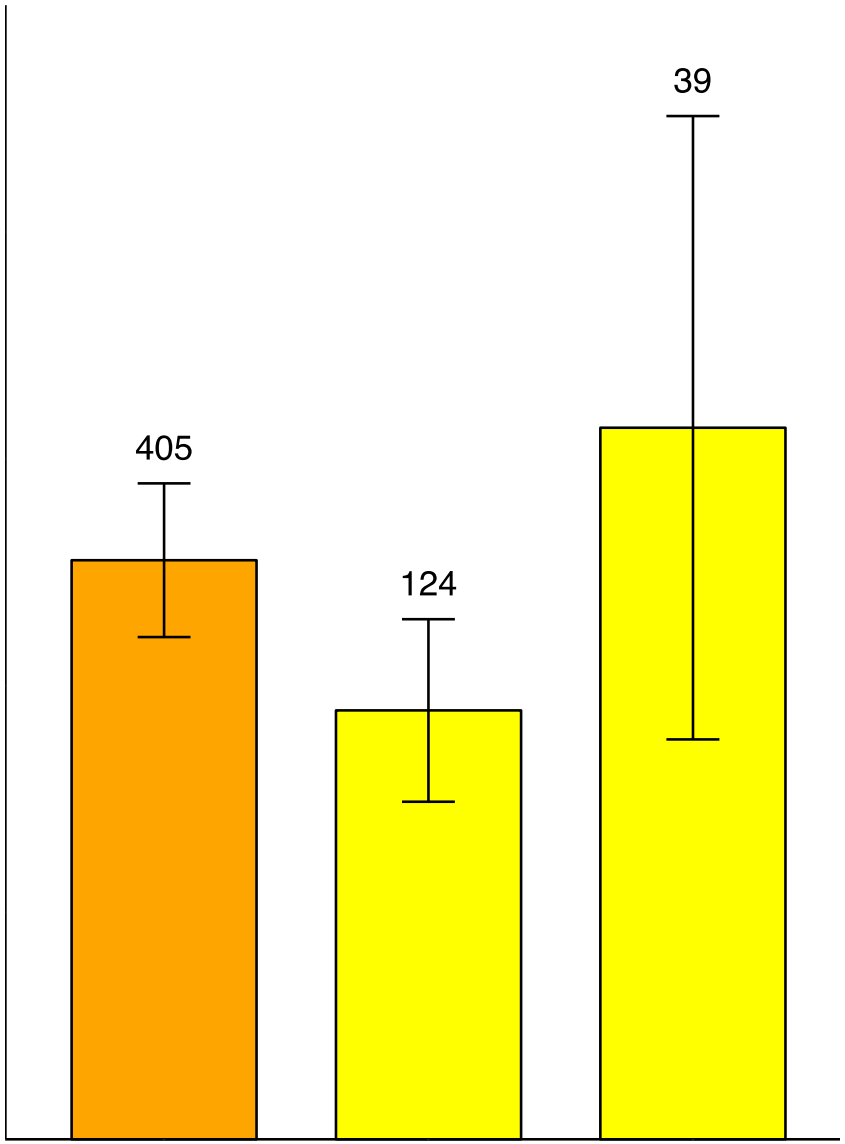
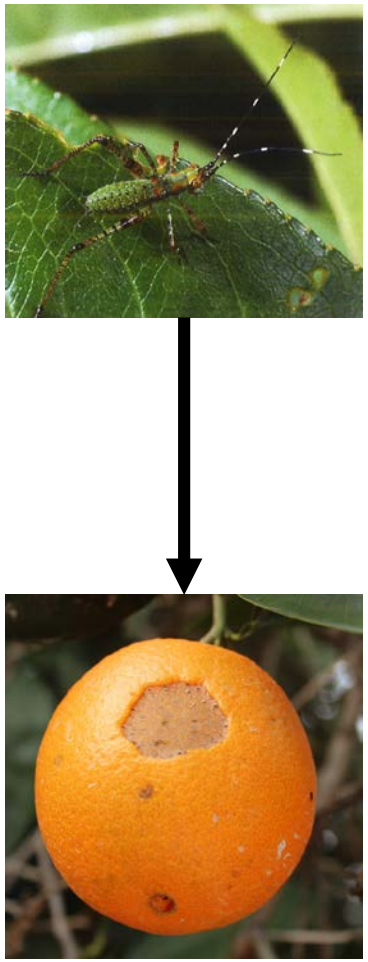
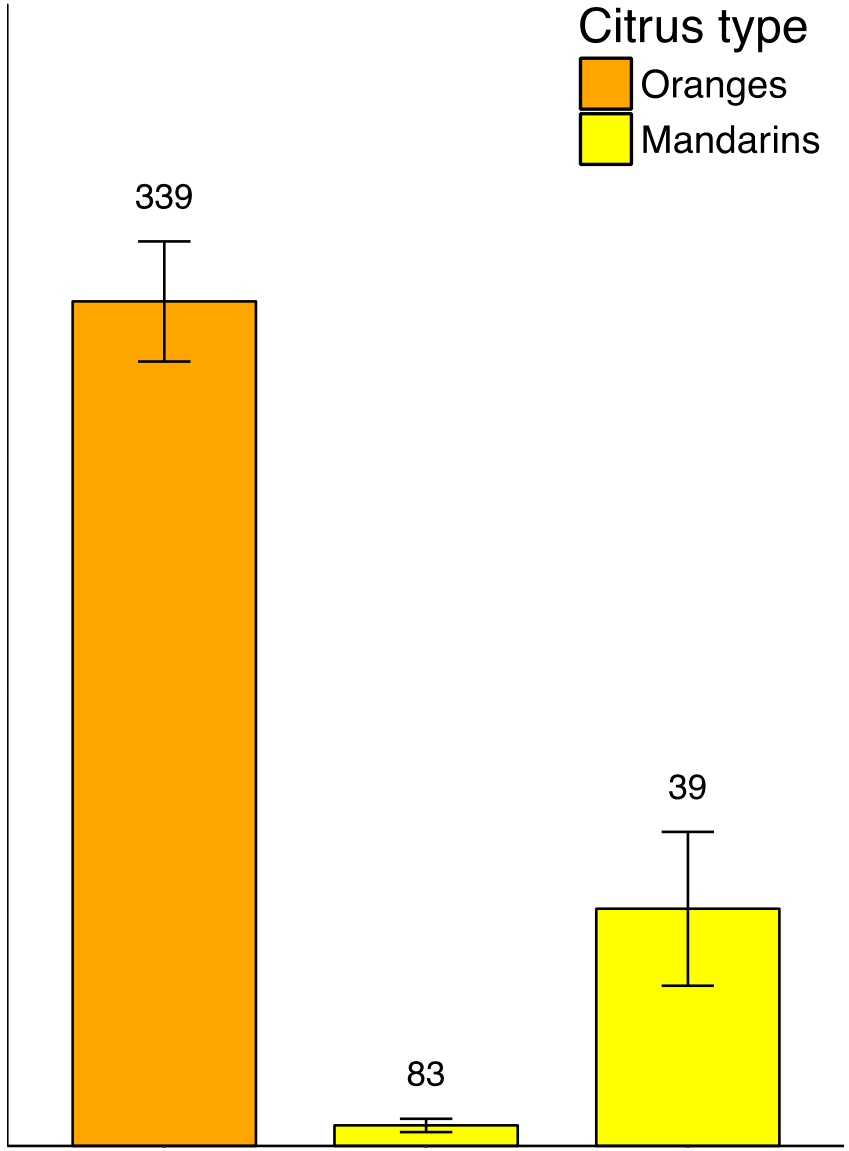


Photo credit: J Kelly Clark, E Grafton-Cardwell UC IPM for Citrus Manual (2012)

Katydids are present in mandarin fields, yet scarring is rare in mandarins







Katydids are present in mandarin fields, yet scarring is rare in mandarins

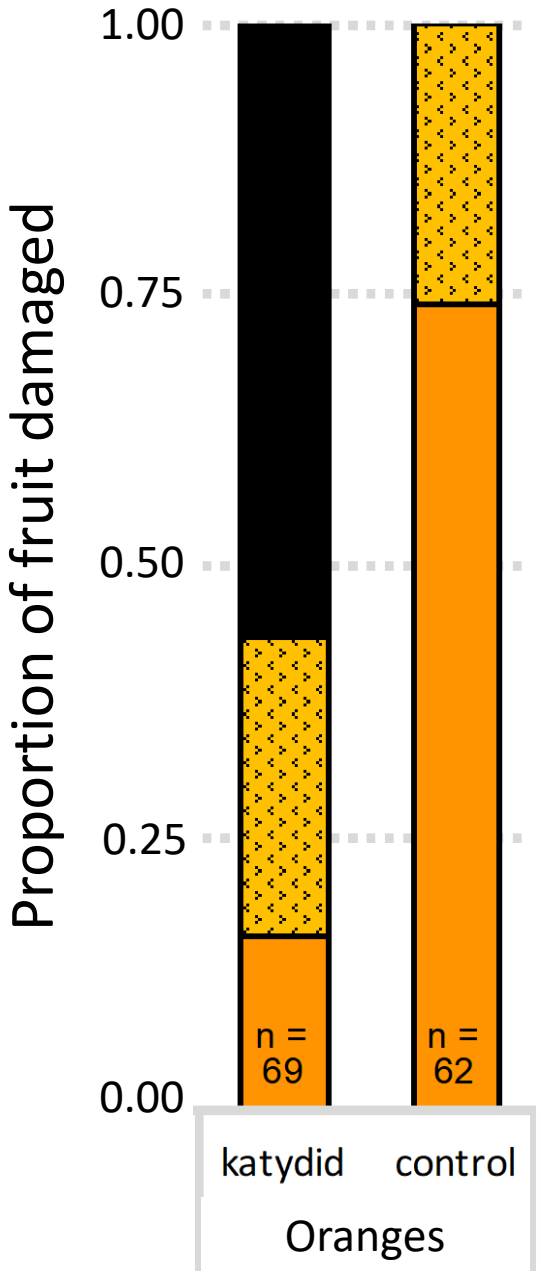
Are we ready to update the IPM guidelines?

Hypotheses for underlying mechanism:

1. **Feeding preference**
2. **Preferential abscission of damaged fruit**
3. **Different scar appearance**

…have different management implications

Hypothesis 1. Feeding preference

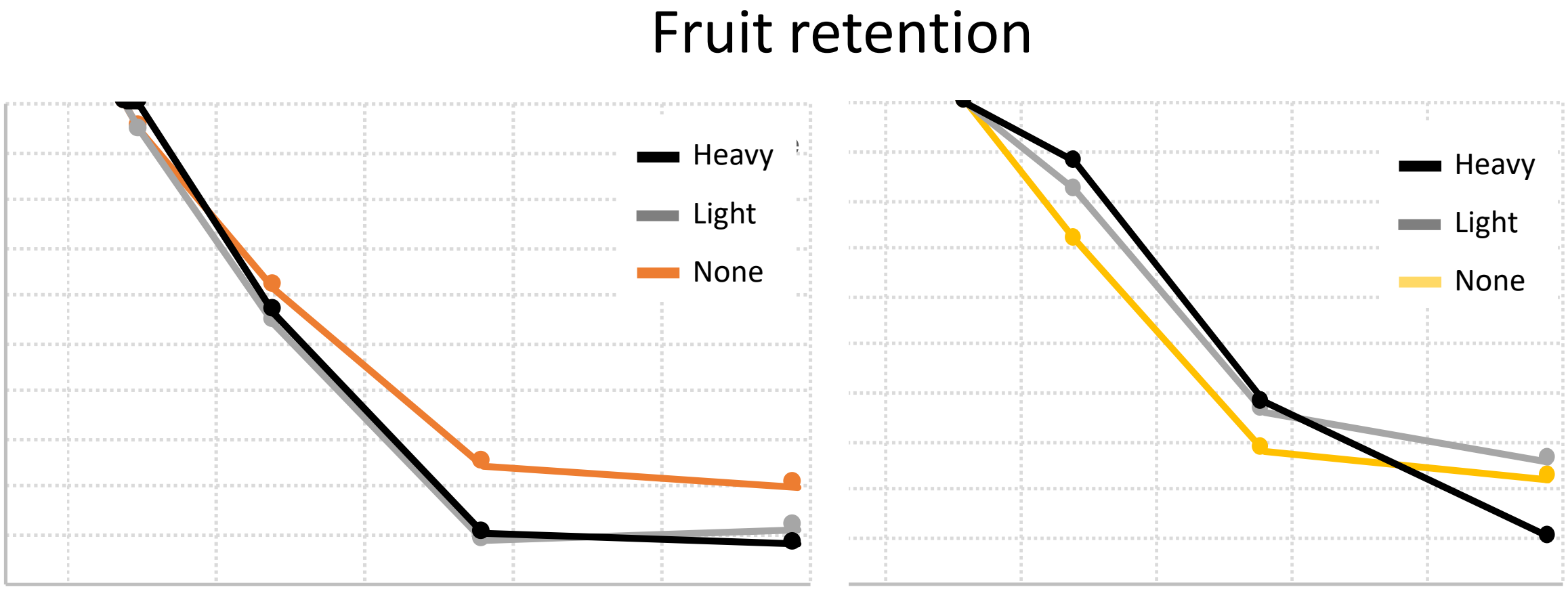


Deep chewed holes

Surface scratches

No damage

Hypothesis 2. Preferential abscission of damaged fruit



Hypothesis 3. Different scar appearance

Deep chewed holes

Oranges

Surface scratches

Mandarins

Summary

A large ecoinformatics database of commercial pest management in citrus showed that **katydids are present in mandarin fields, yet scarring is rare in mandarins**

Field experiments suggest that this is due to:

1. **Feeding preference** i.e. previously unrecognized natural resistance

…Katydids might not be a pest in mandarins

Growers have responded positively to results generated from their own data

Acknowledgements

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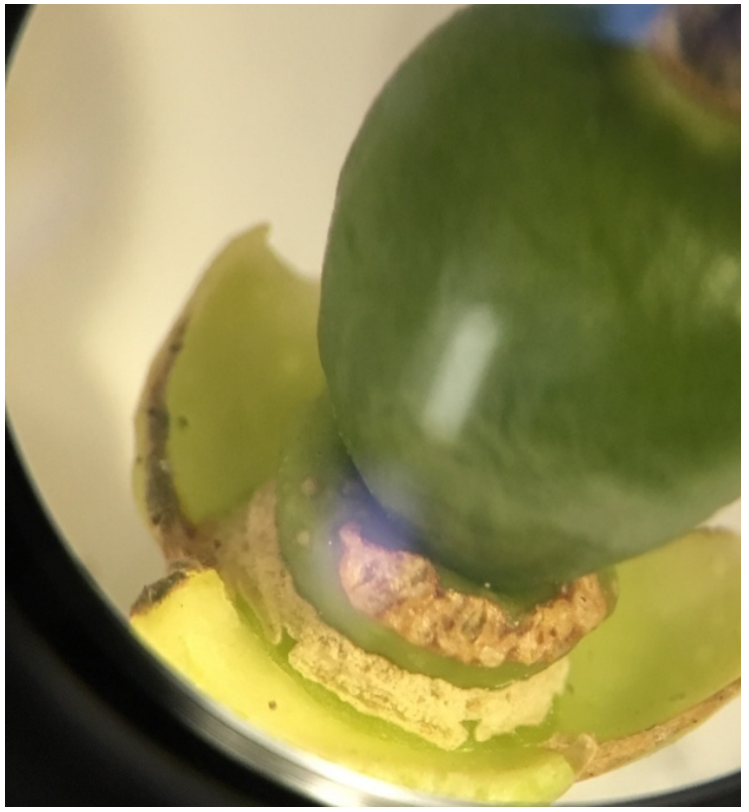
Hypothesis 1. Feeding preference – floral feeding

Petals

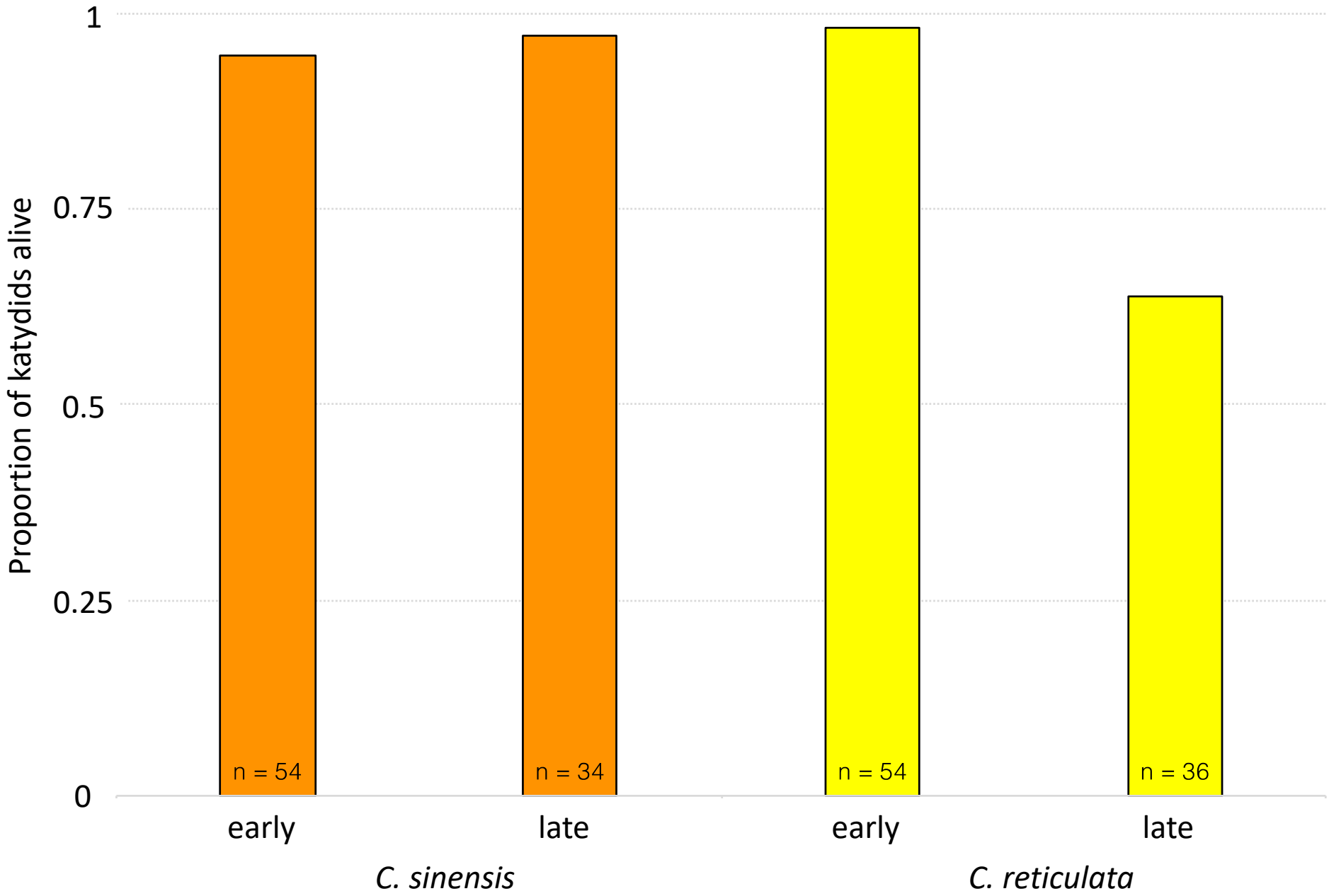
Style

Floral disc

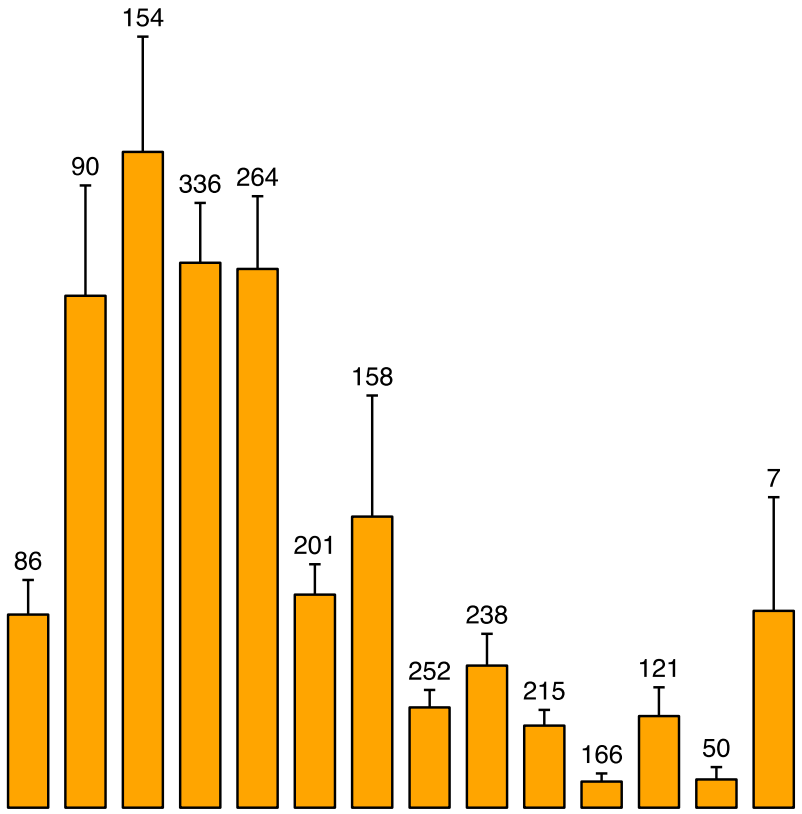


Foliar damage - none

Hypothesis 1. Feeding preference – katydid survival



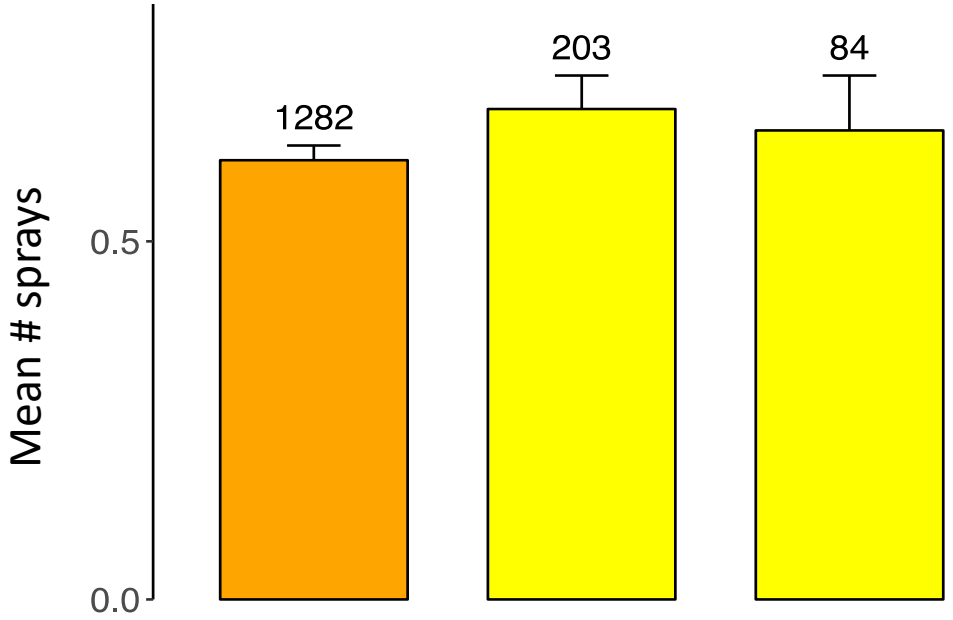
Hypothesis 1. Feeding preference – katydids in commercial fields



Forktailed bush katydid

Scudderia furcata

- Cause deep fruit scars and leaf damage
- No research-based economic injury level
- Broad-spectrum organophosphates & pyrethroids most effective control options



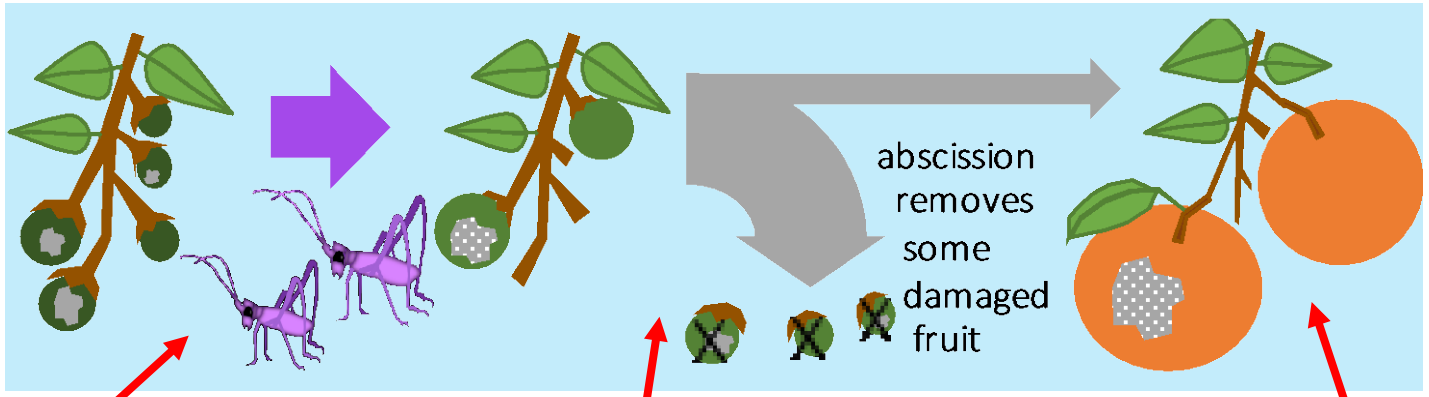
Researcher-generated survey of katydid scarring

From 21 citrus fields

125 of 9446 oranges vs. **2 of 8537 mandarins**

had katydid scars at harvest

Field experiments



1. Feeding preference

2. Preferential abscission

3. Developmental recovery/ modification

Heavy damage (deep chewed holes) in oranges

Light damage (shallow cuts/scratches) in mandarins

Katydids are present in mandarin fields, yet scarring is rare in mandarins

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