Effects of temperature and humidity on BMSB

Joanna Fisher, Jhalendra Rijal, Frank Zalom

Department of Entomology and Nematology, UC Davis

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Specialty Crop Research Initiative

Collaborating Institutions

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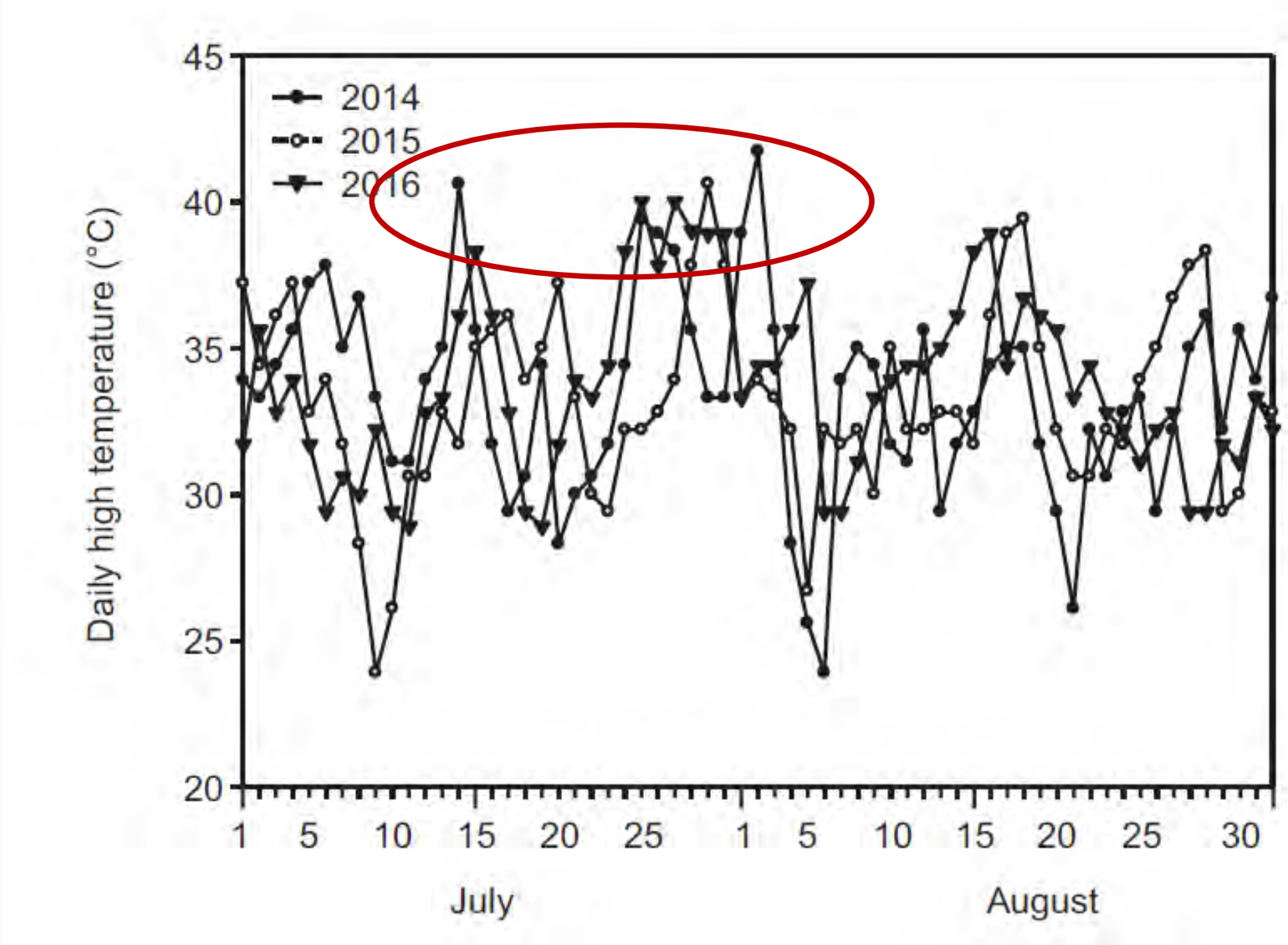
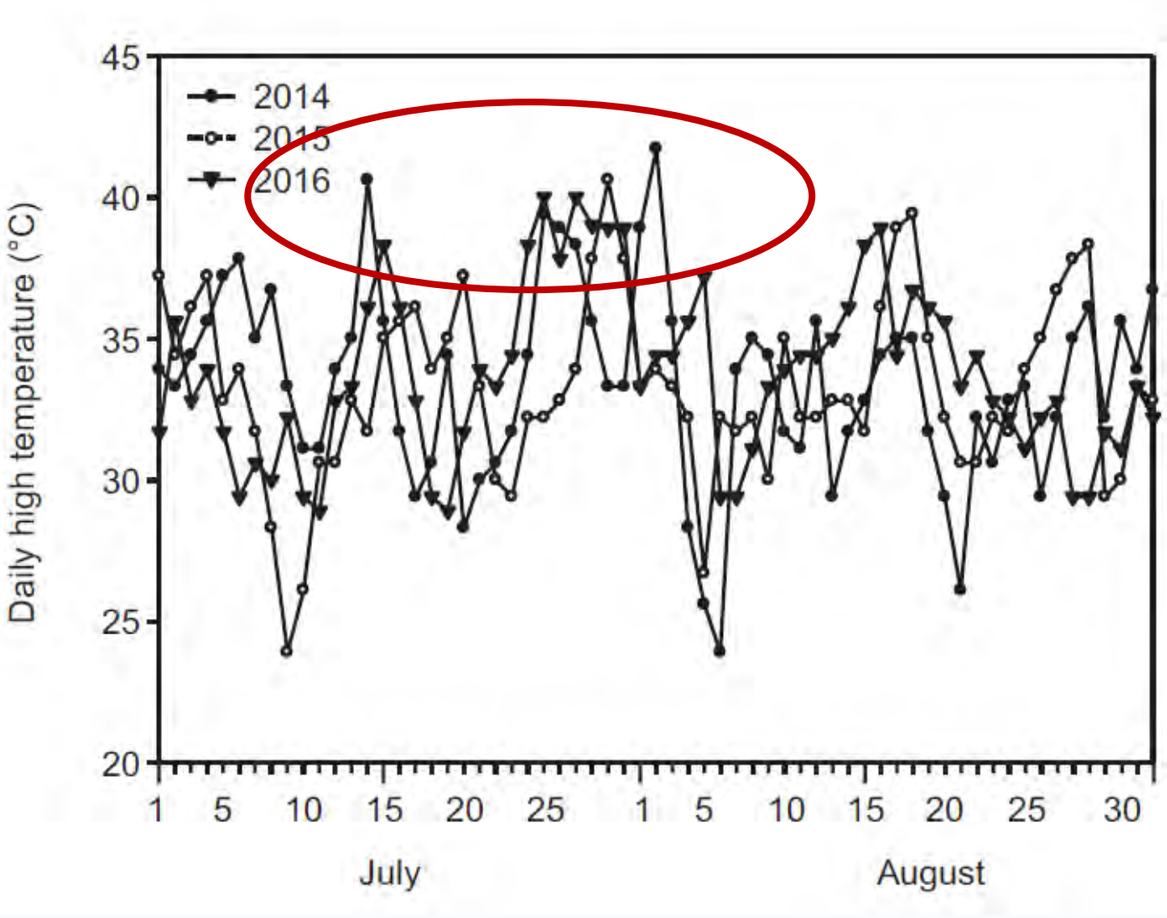
Tree in Sacramento CA 2015
Photo: Chuck Ingles

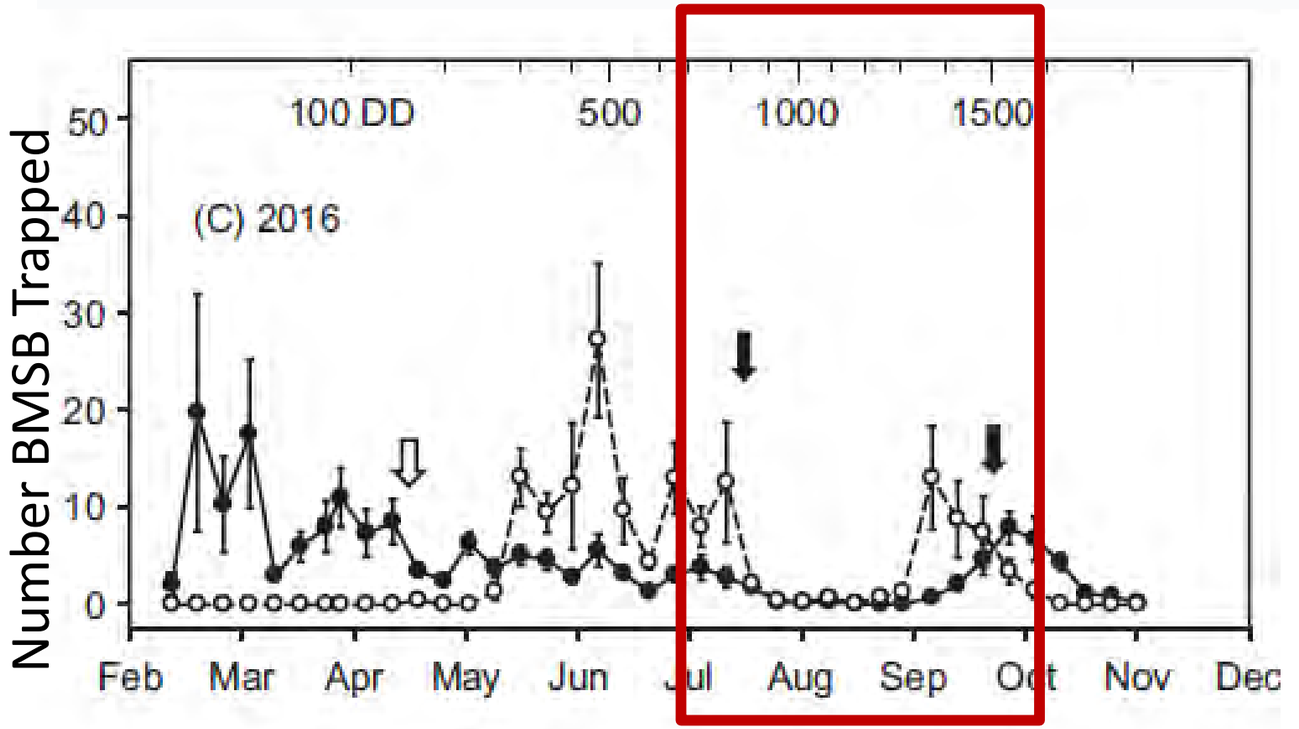
Unusual number of hot temp days in Jul + Aug 2016 (above 35°C and below 16% RH)



Ingles and Daane, 2018 J. Econ. Entomol.

Unusual number of hot temp days in Jul + Aug 2016 (above 35°C and below 16% RH) followed by near zero trap counts





Ingles and Daane, 2018 J. Econ. Entomol.

Goal: Determine effect of field temperature and humidity on BMSB survival

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Placed egg masses in 3 sites in different counties in California

Community Garden
Sacramento County

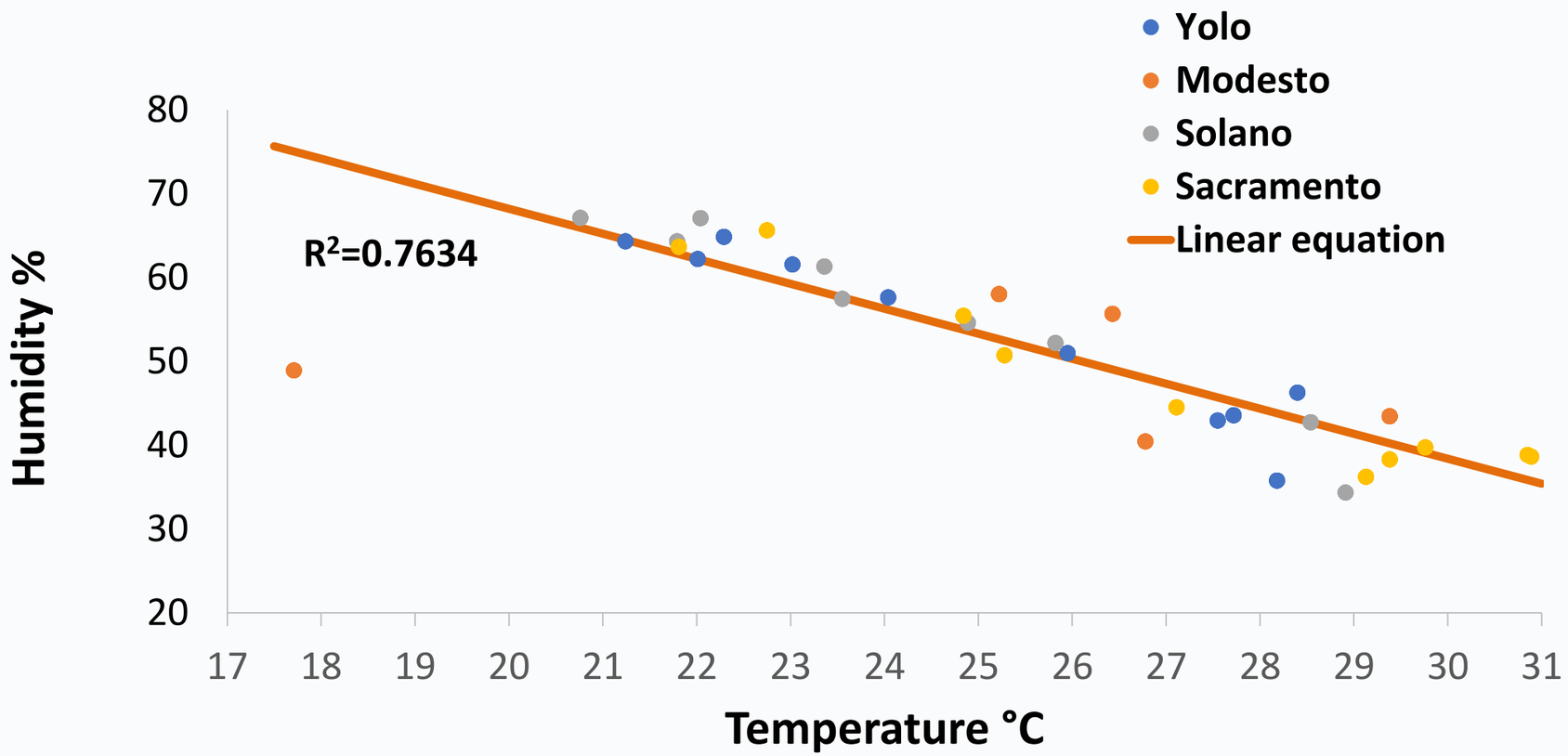
Almond Trees
Stanislaus County

Tree of Heaven
Yolo County

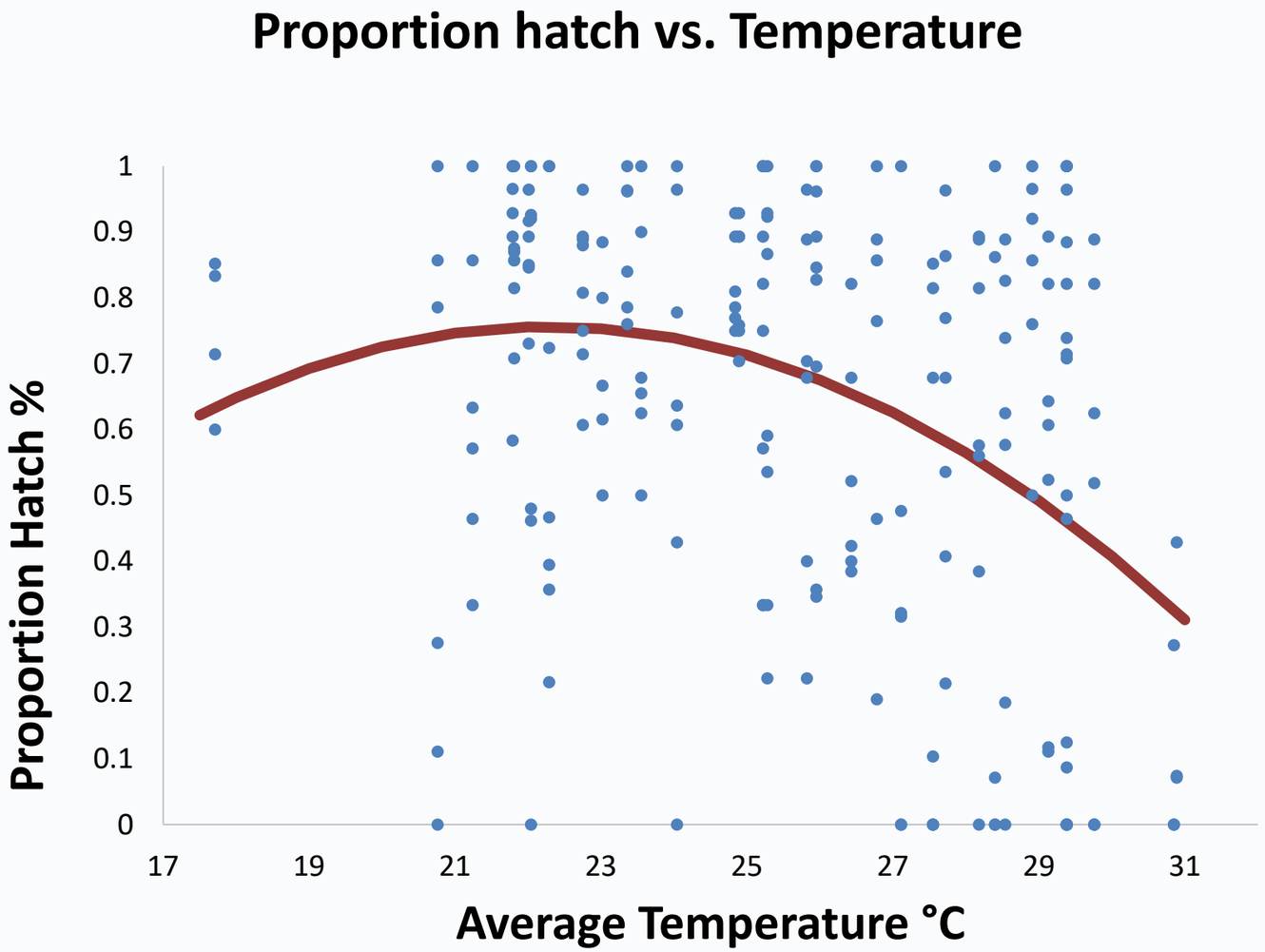
Cherry Orchard
Solano County

- **Eggs left in the field for approximately 48 hr., recorded field temp and rh**
- **Reared out in the lab until the 2nd instar**
- **Repeated 13 times from 7/26-9/4 2017**

Temperature and Humidity at 4 sites Jul-Sept 2017



Strong linear relationship between temp and humidity in the field so can't determine individual effect of temperature vs. humidity.



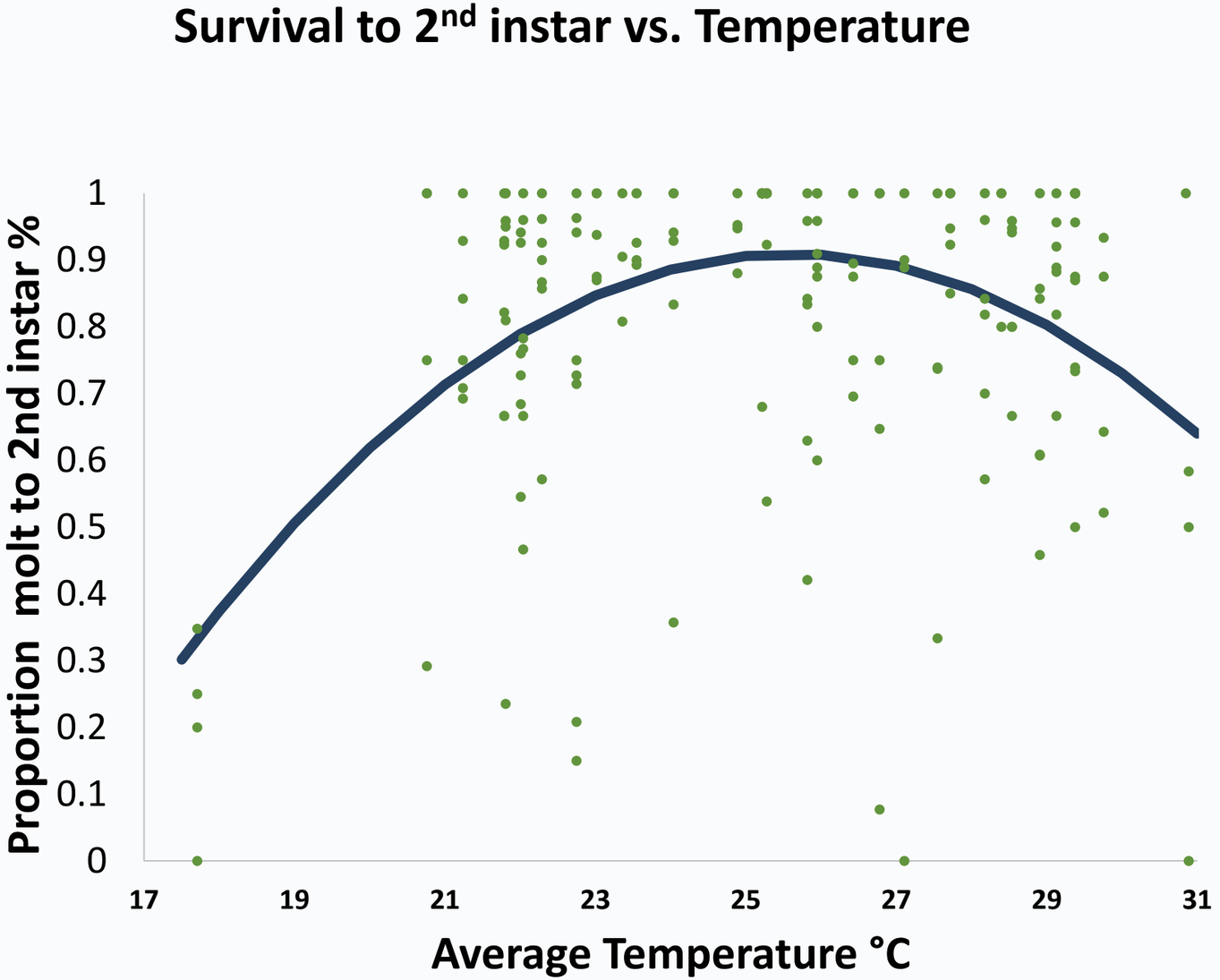
Temperature and humidity (are highly correlated) influenced egg hatch

High temp (low RH) and low temp (high RH) decrease hatch rate

Temperature and humidity (are highly correlated) influenced survival to the 2nd instar

High temp (low RH) and low temp (high RH) decrease survival to 2nd instar

Overall finding: High temperatures in the central valley decreased BMSB hatch and nymph survival



- Adults placed weekly in bags on almond trees in Modesto CA
- Mortality recorded after 1 week
- Repeated weekly from 3/27-8/22, 2018

Jhalendra Rijal

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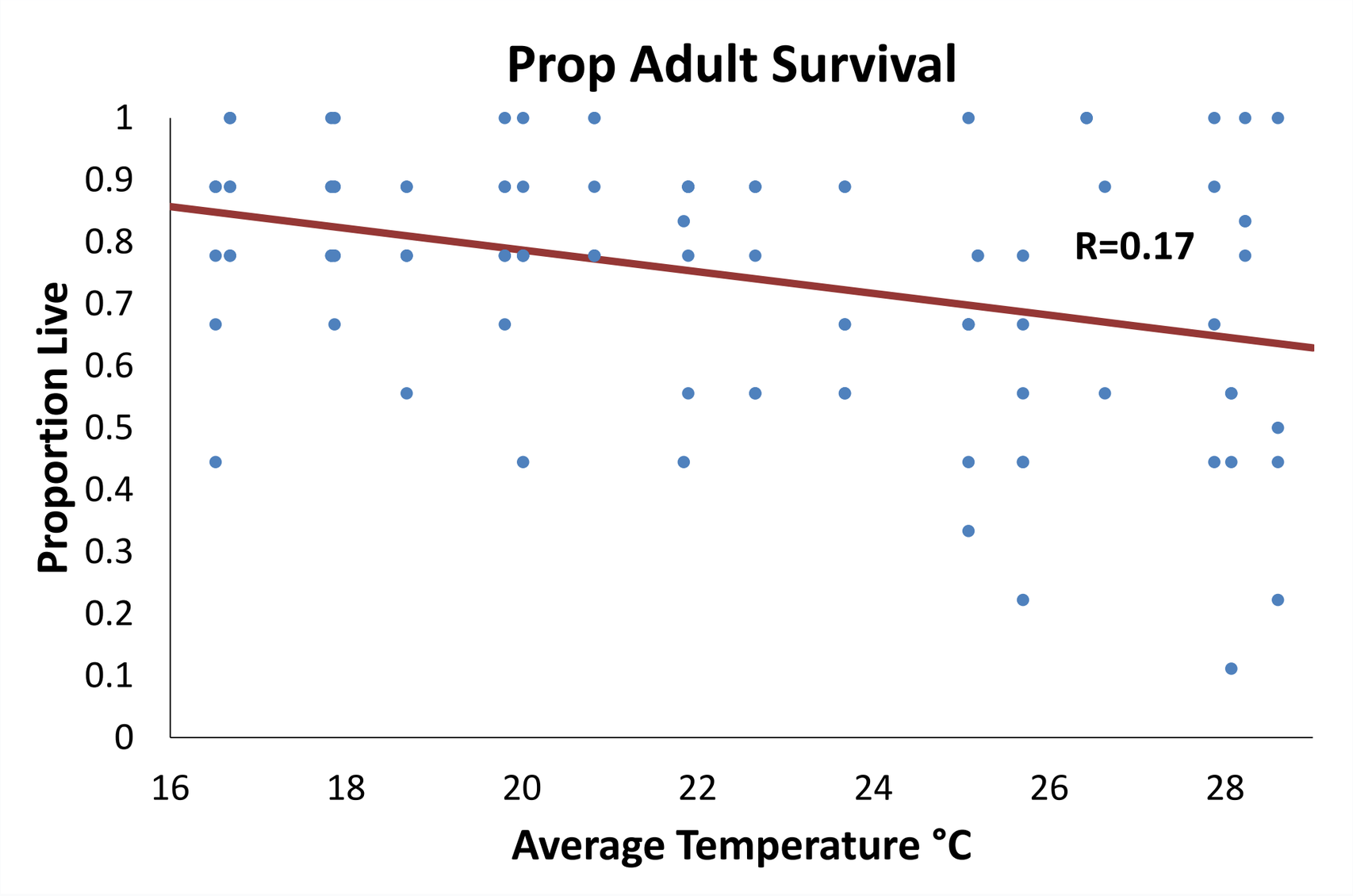

- **Significant effect of temperature p=.0010**
- **Adults have reduced survival at high temperatures and low RH**

What we learned from the field study

Temperature and humidity are highly correlated

Observed BMSB population declines in the field are at least partly the result of high temperature and low humidity events

Is Temperature or Humidity more Important for Predicting BMSB Mortality?

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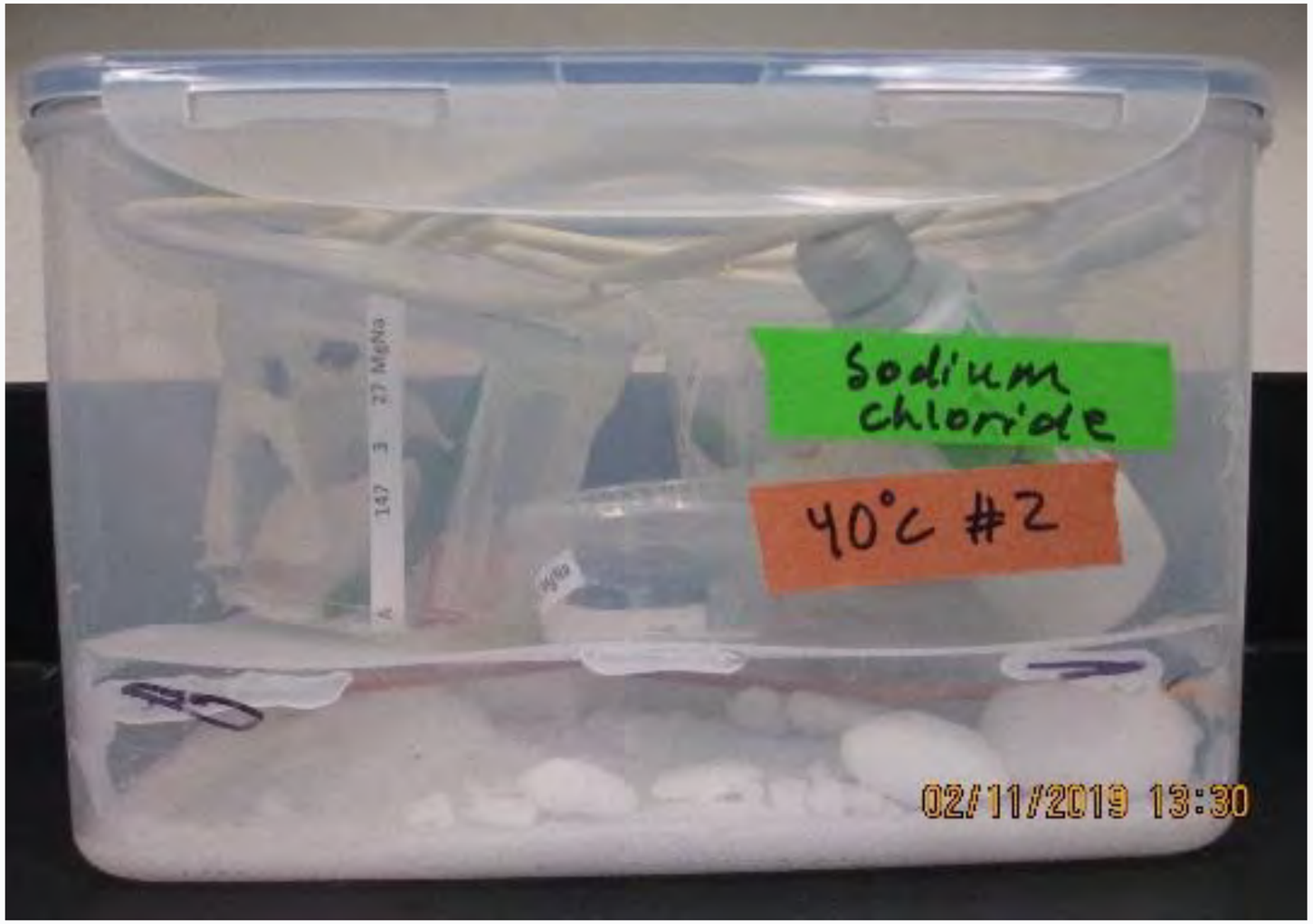
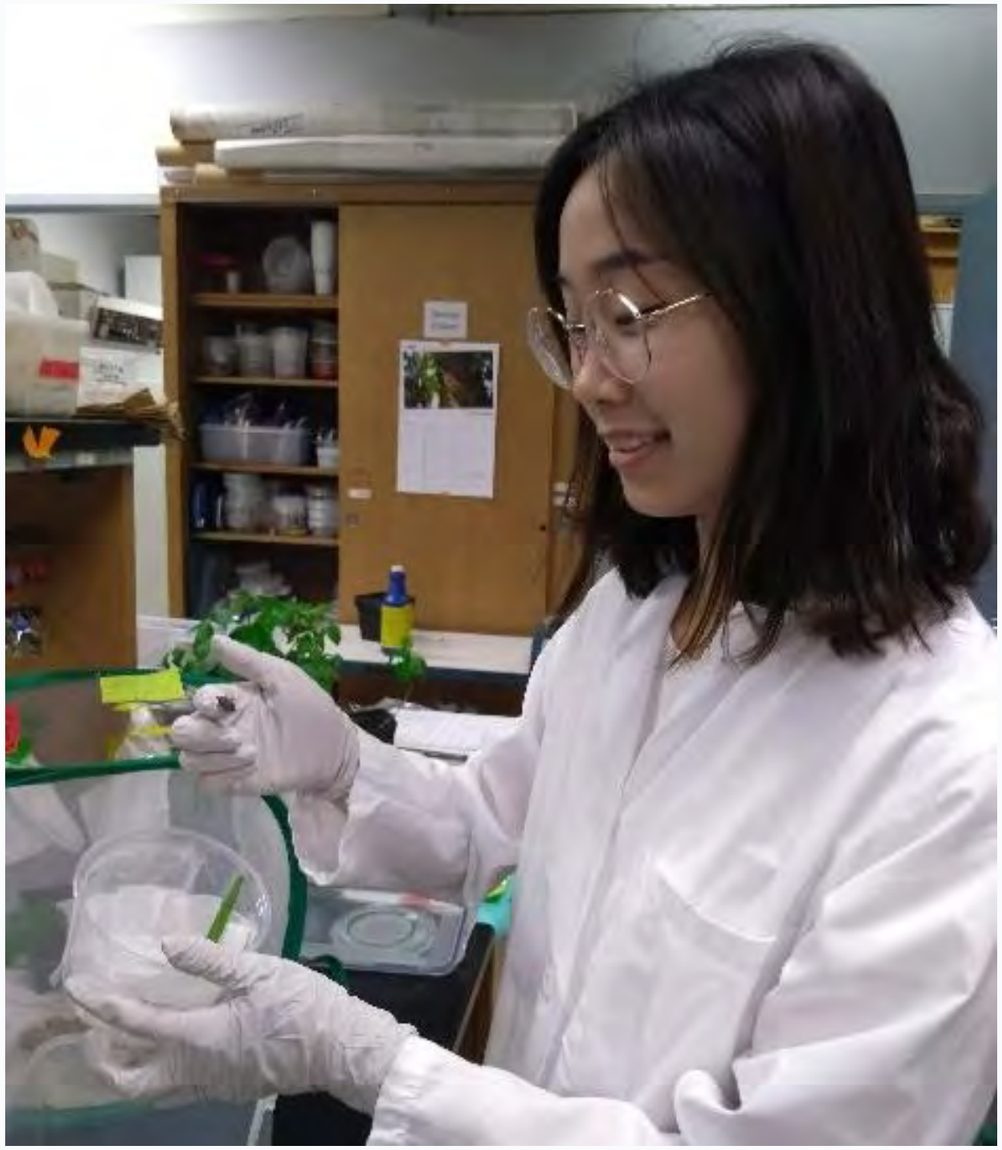
Back to the Lab!





Insect life stages

1st instars

Bugwood.org UGA 1460052

3rd-4th instars

W. Hershberger

Adults

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X

Avg. Humidity

19%

38%

54%

73%

X

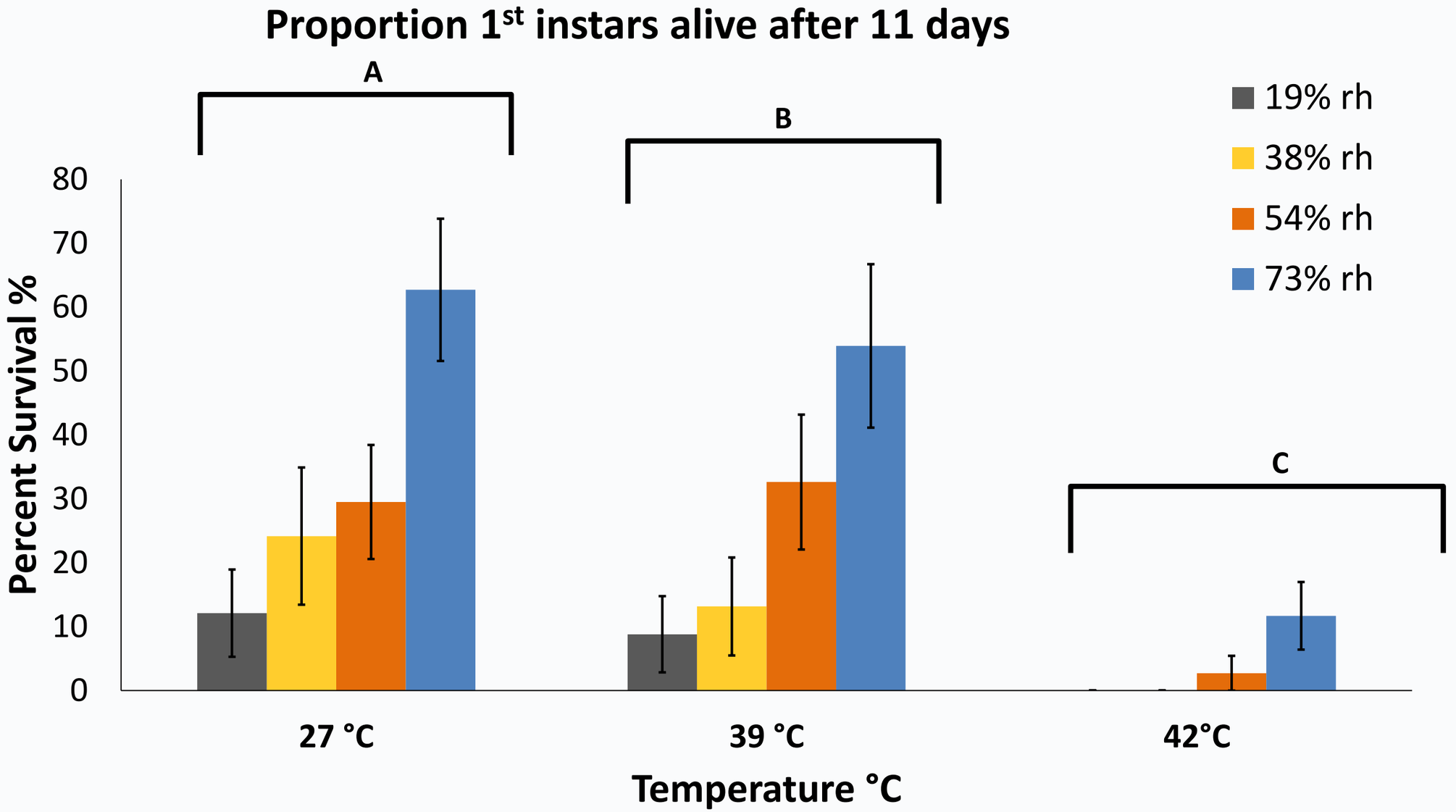
2 day high temp exposure

Ambient: 27°C const

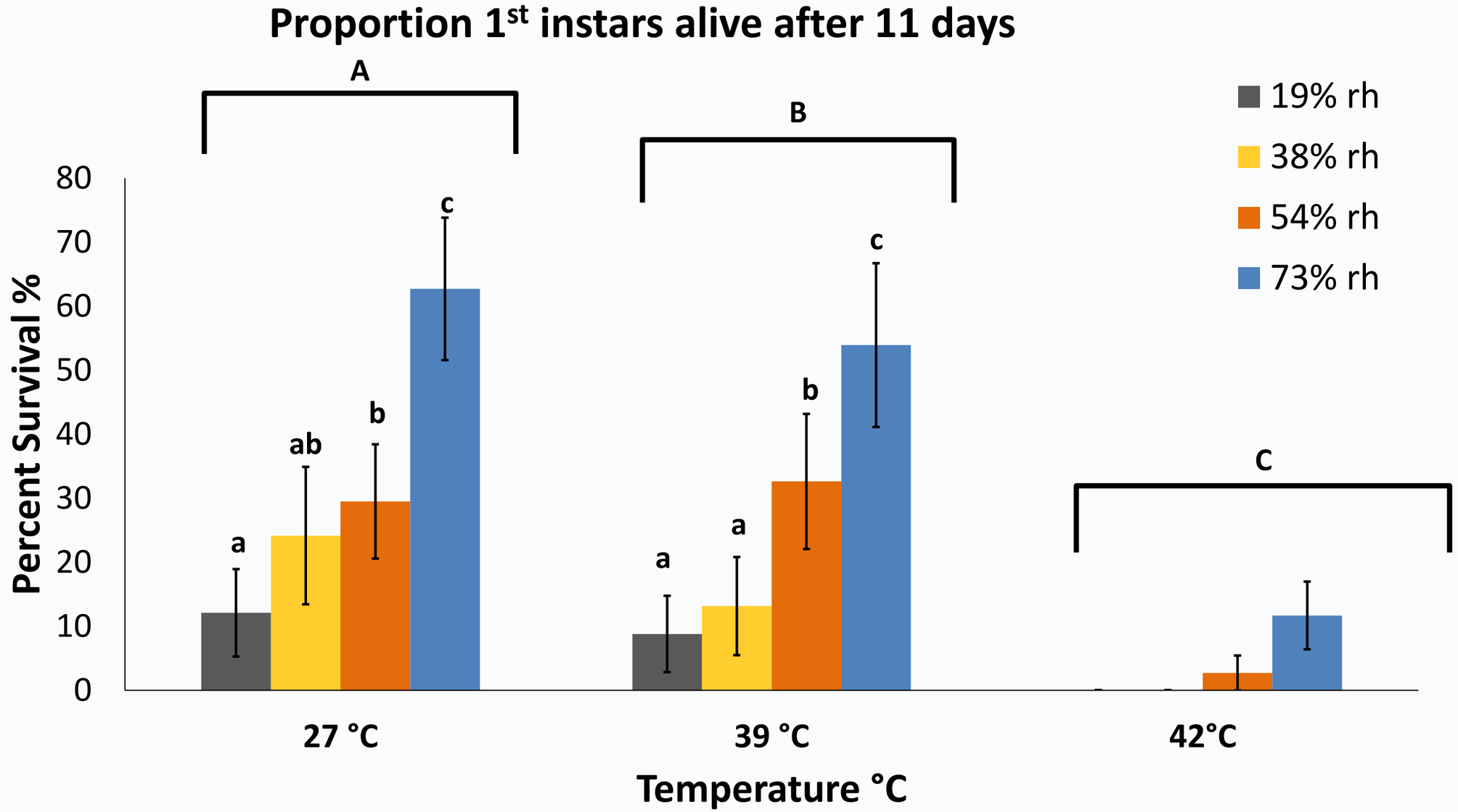
High temp: 39° C 3.75hr.

Very high temp: 42° C 3.75hr.

- **High temperature exposure significantly decreases 1st instar survival**

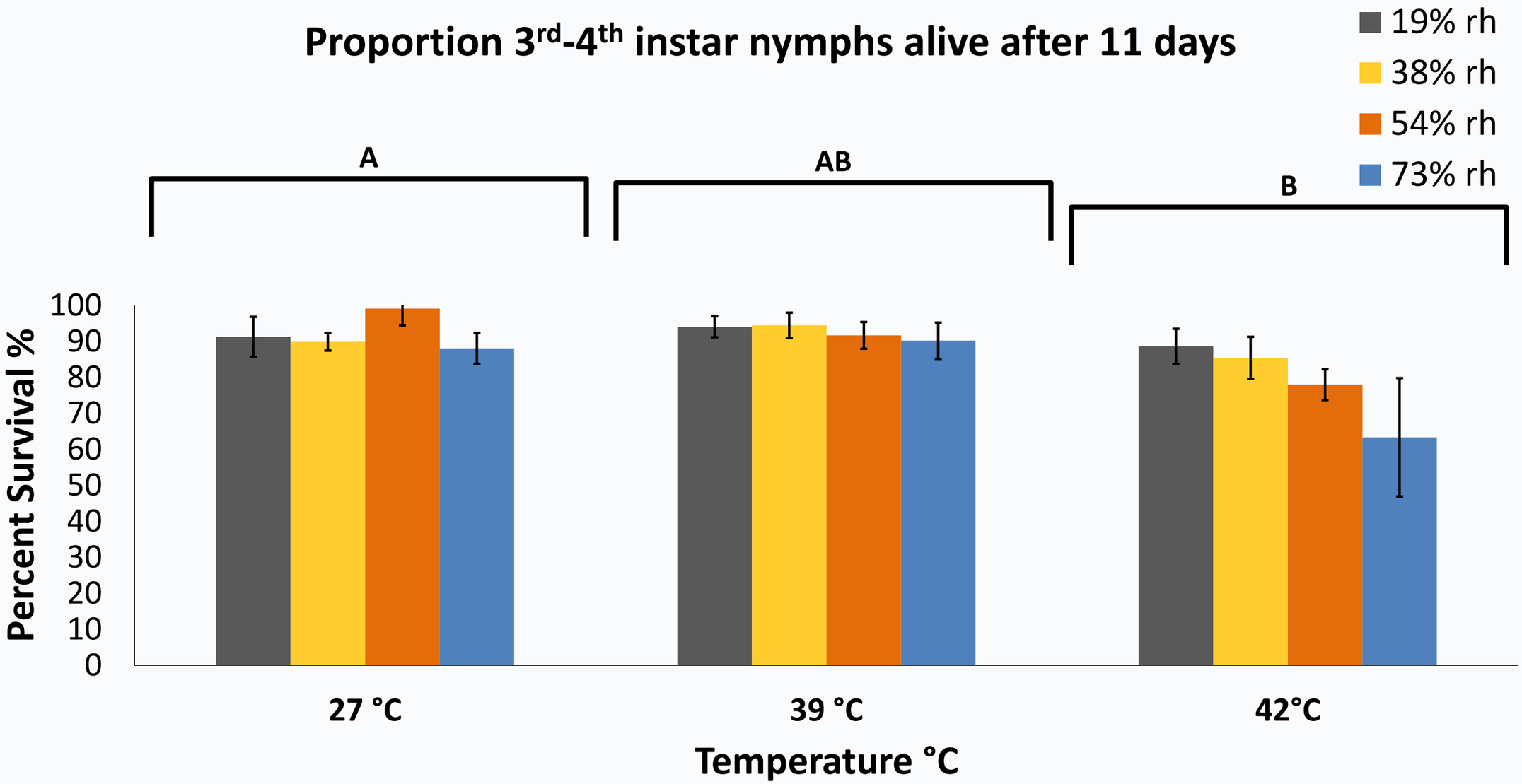


- High temperature exposure significantly decreases 1st instar survival
- At 27°C and 40°C low humidity significantly decreased survival



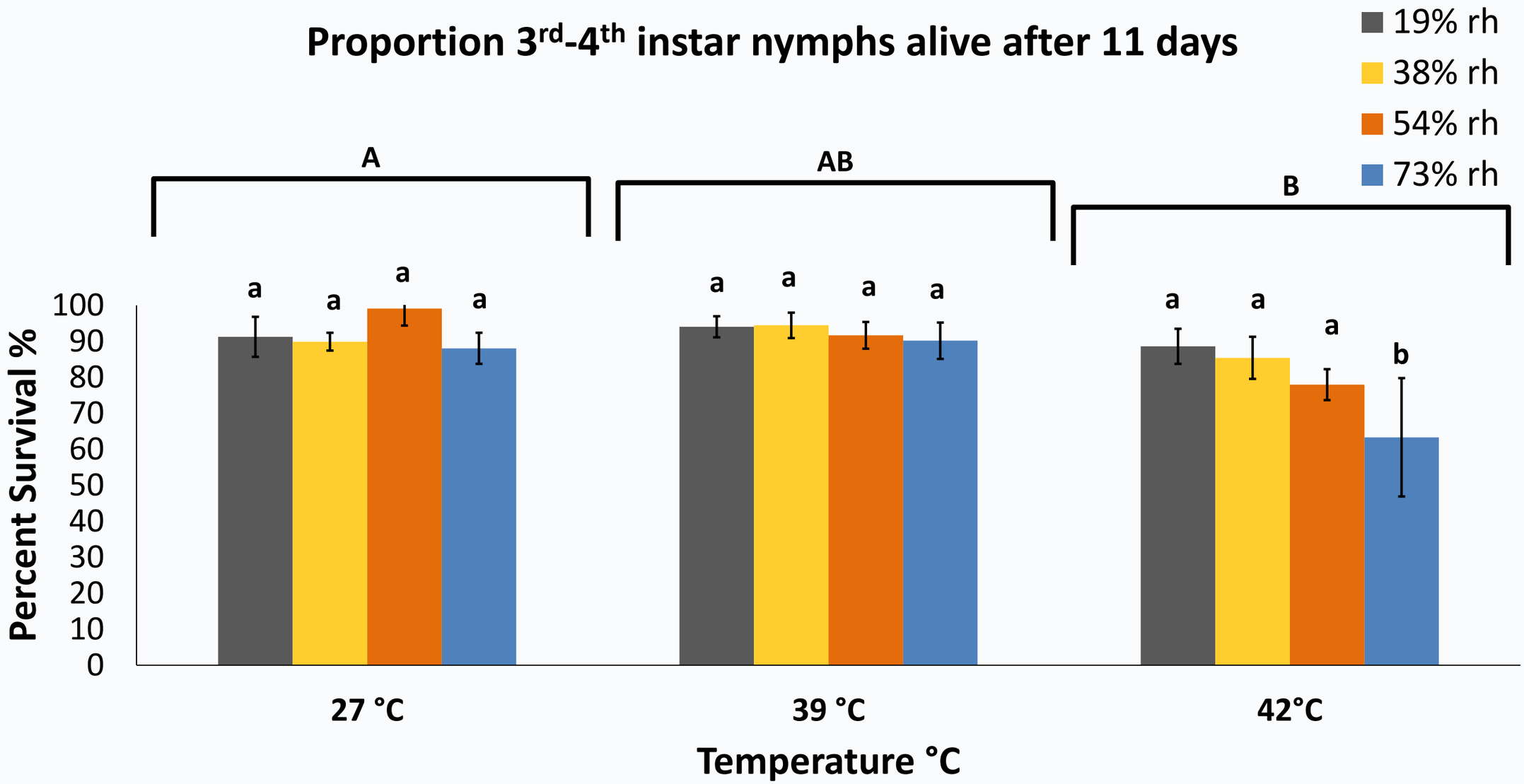
- **Older nymph survival decreased after exposure to 42°C vs. lower temperatures**

W. Hershberger



- **Older nymph survival decreased after exposure to 42°C vs. lower temperatures**
- **Exposure to low RH decreased survival only for nymphs exposed to 42°C**

W. Hershberger



- **Exposure to 42°C significantly decreased adult survival**

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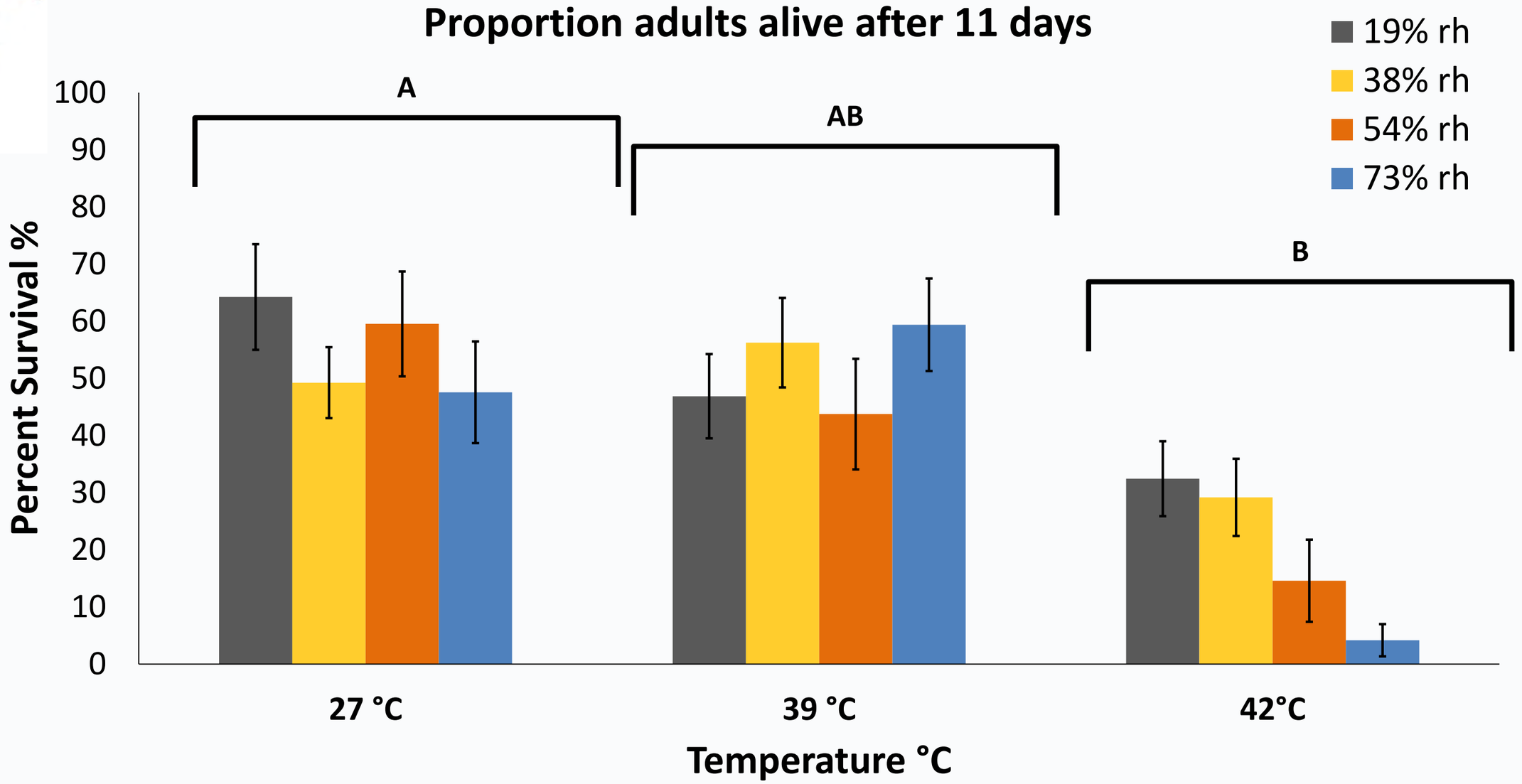

- **Exposure to 42°C significantly decreased adult survival**
- **No significant effect of humidity within temperature treatments**

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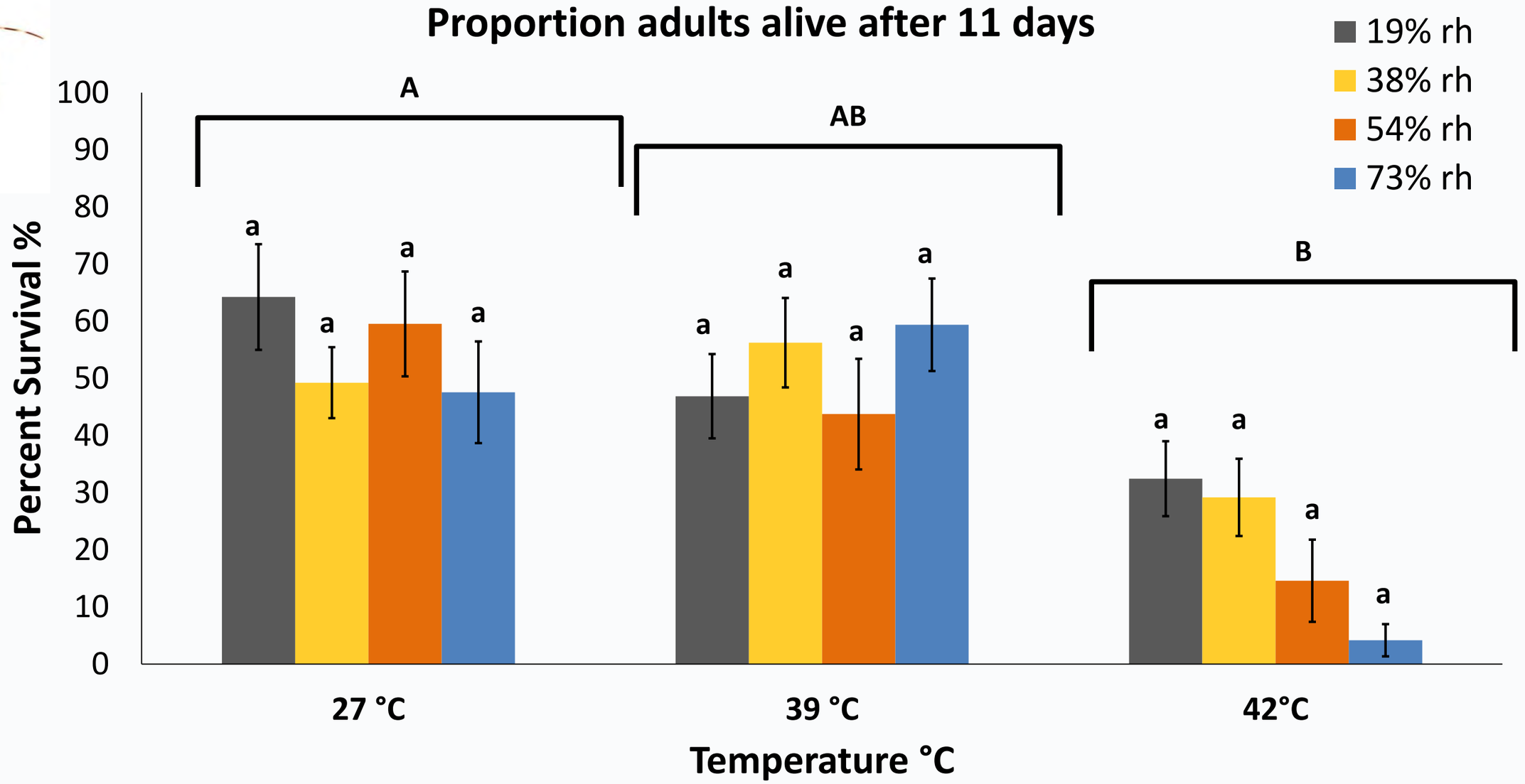
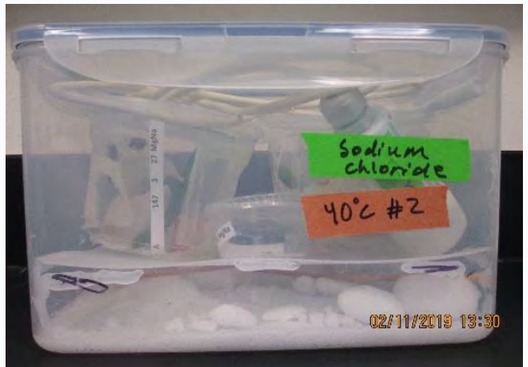


Conclusions: Lab Study

- **Exposure to 42°C significantly decreased BMSB survival for all life stages**
- **Whether or not humidity influenced BMSB survival depended on the temperature and BMSB life stage**
  - **1st instars were very susceptible to low humidity at all temperatures**
  - **High humidity (73%) decreased survival of 3rd-4th instars but only at 42°C**
  - **There was no effect of humidity for adults**



Conclusions

- **Our results suggest that high temperature events can lead to decreases in BMSB populations.**

- **The impact of high temperature events on BMSB populations will depend on the relative humidity and what insect life stages are exposed.**

Acknowledgments

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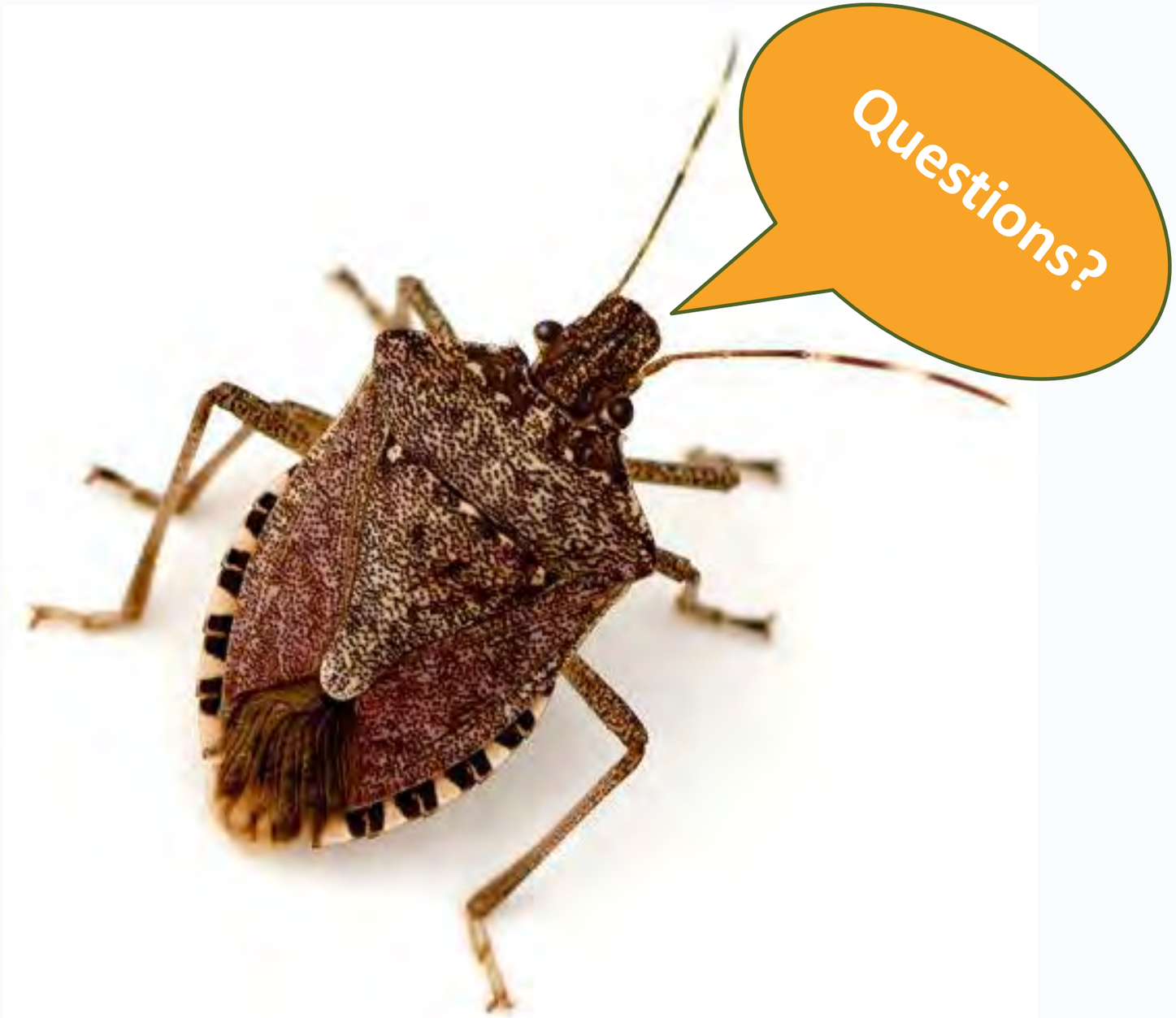

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