Abiotic factors and the role they play in BMSB egg mass sterilization and survivorship

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Previously…

- 2 species of bacterial symbionts have been detected from BMSB dissections
  - A Gammaproteobacteria in the genus *Pantoea*
    - Focus is on this species, which is smeared on the EM for nymphal acquisition post-eclosion
    - Identified on the egg mass surface as well as within the midgut crypts
  - A species of *Wolbachia*

M. Raupp

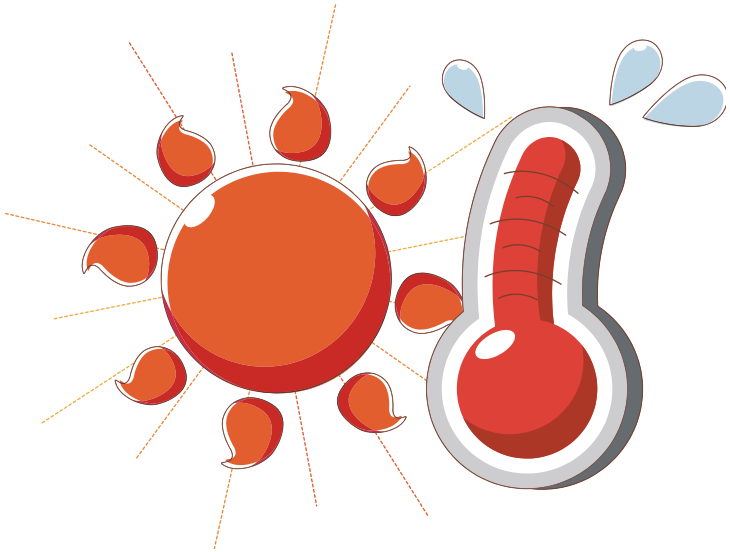
Previously…

- Our work has confirmed that experimental removal of the symbiont has negative effects on BMSB survival, development, and fecundity

Objectives

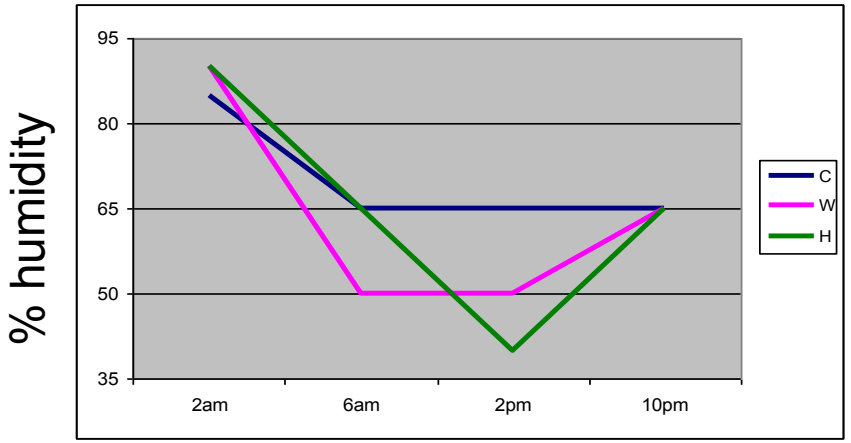
- Previously removed the symbionts chemically to determine host reliance

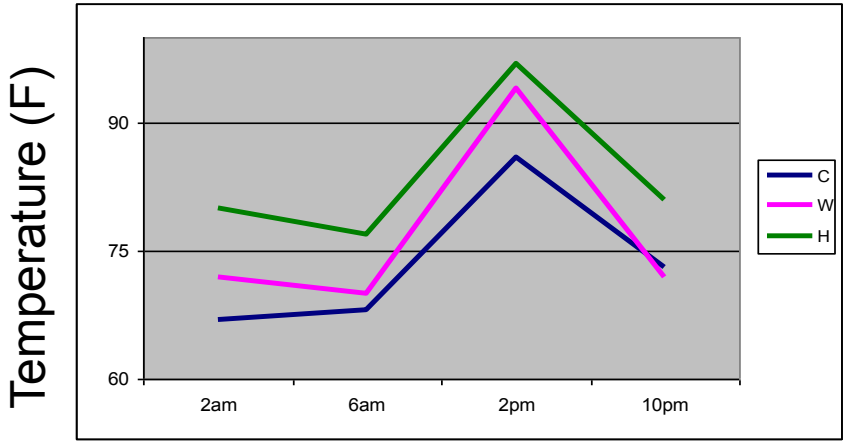
- Now the goal is to determine whether abiotic factors impact the symbionts in a similar way



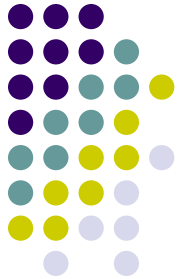
Materials/Methods: Field Condition Chambers

- Mimicked 3 summer day conditions from Beltsville Research Farm
  - Control: ‘Average temperature & high humidity’
  - Warm: ‘Warm temperature & moderate humidity’
  - Hot: ‘Hot temperature & low humidity’





Materials and Methods: EM Treatment Protocol



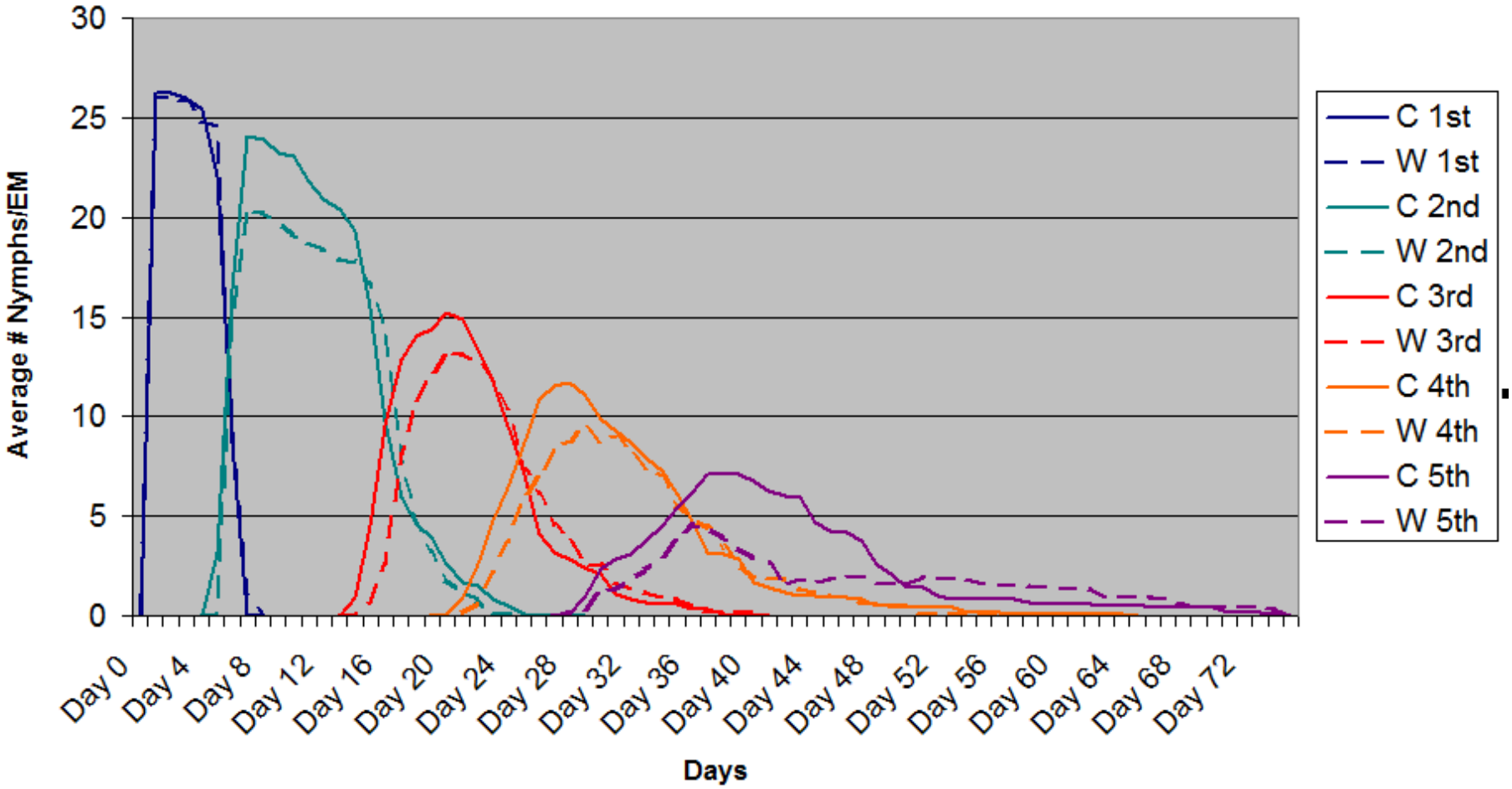
- 30 EMs collected from colony and **left on plants** on which they were laid
- Randomly assigned to 1 of 3 treatments (Control, Warm, and Hot)
- Only exposed to mimicked field condition chambers **until eclosion**, and then plants were removed and EM's reared at 25 Celsius, 75%humidity, 16:8 L:D cycle until the adult stage

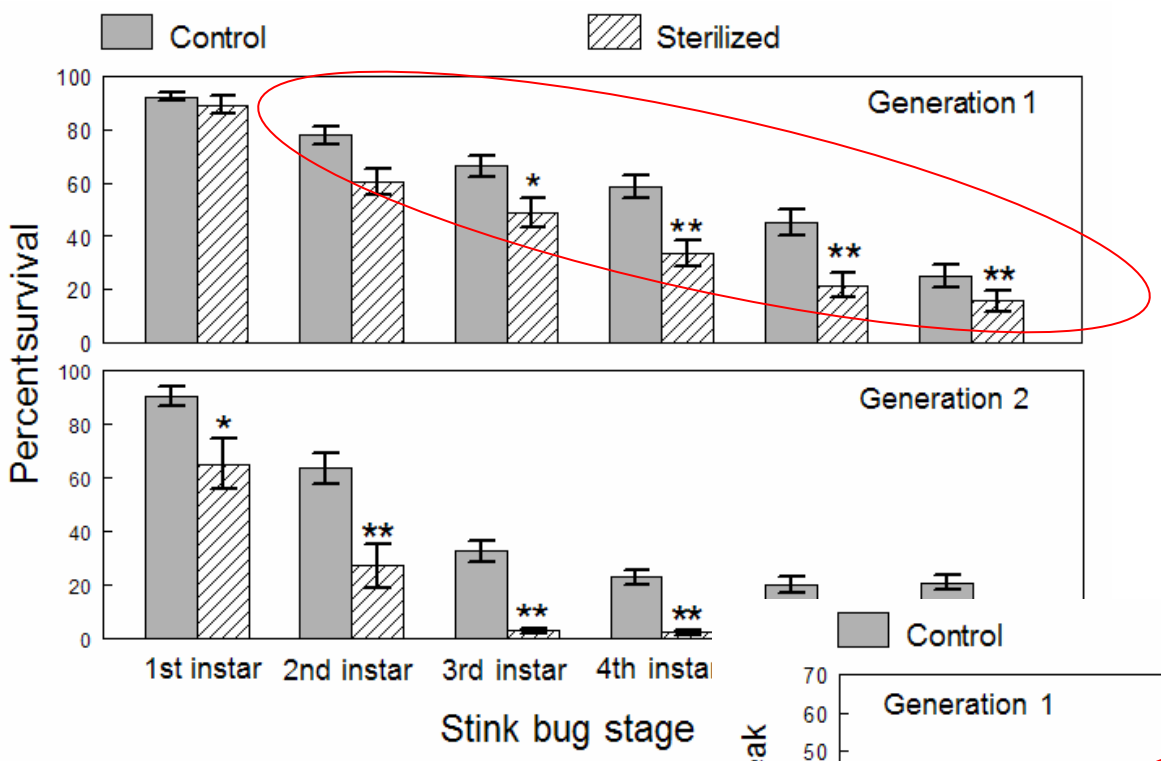
Results: Hatch Rate

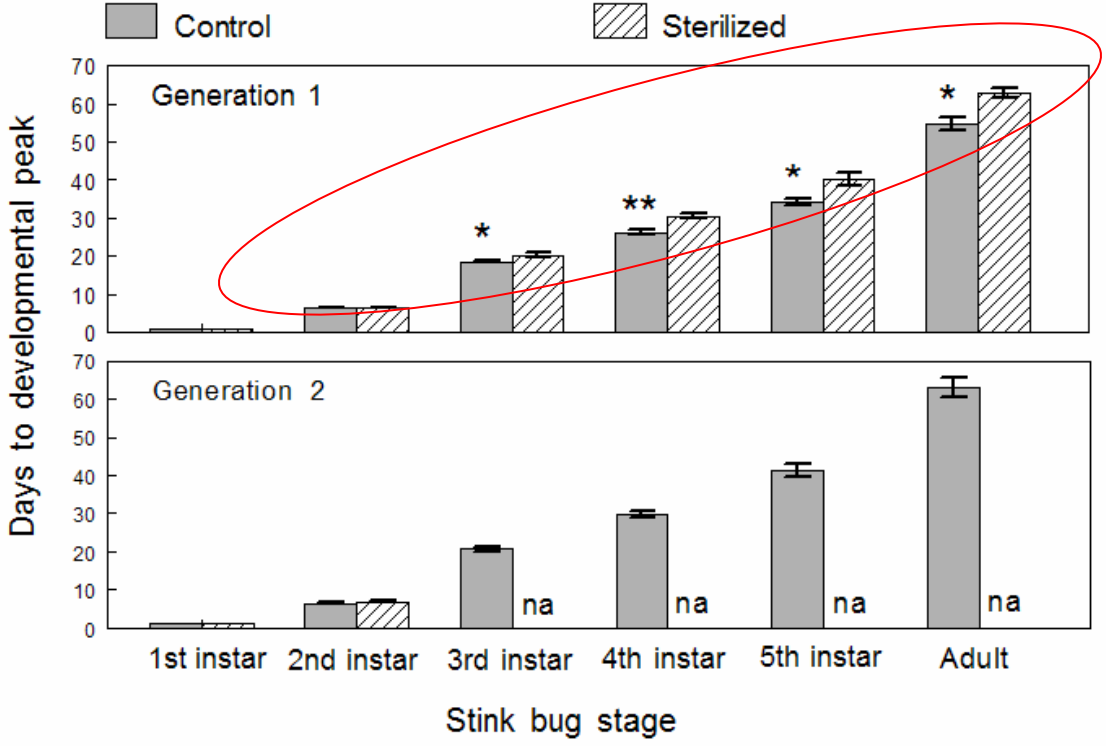
- Control: 96.7% hatch rate
- Warm: 96.3% hatch rate
- Hot: 40% hatch rate

	DF	*p*
C vs. W	27	.9823
C vs. H	27	<.0001
W vs. H	27	<.0001

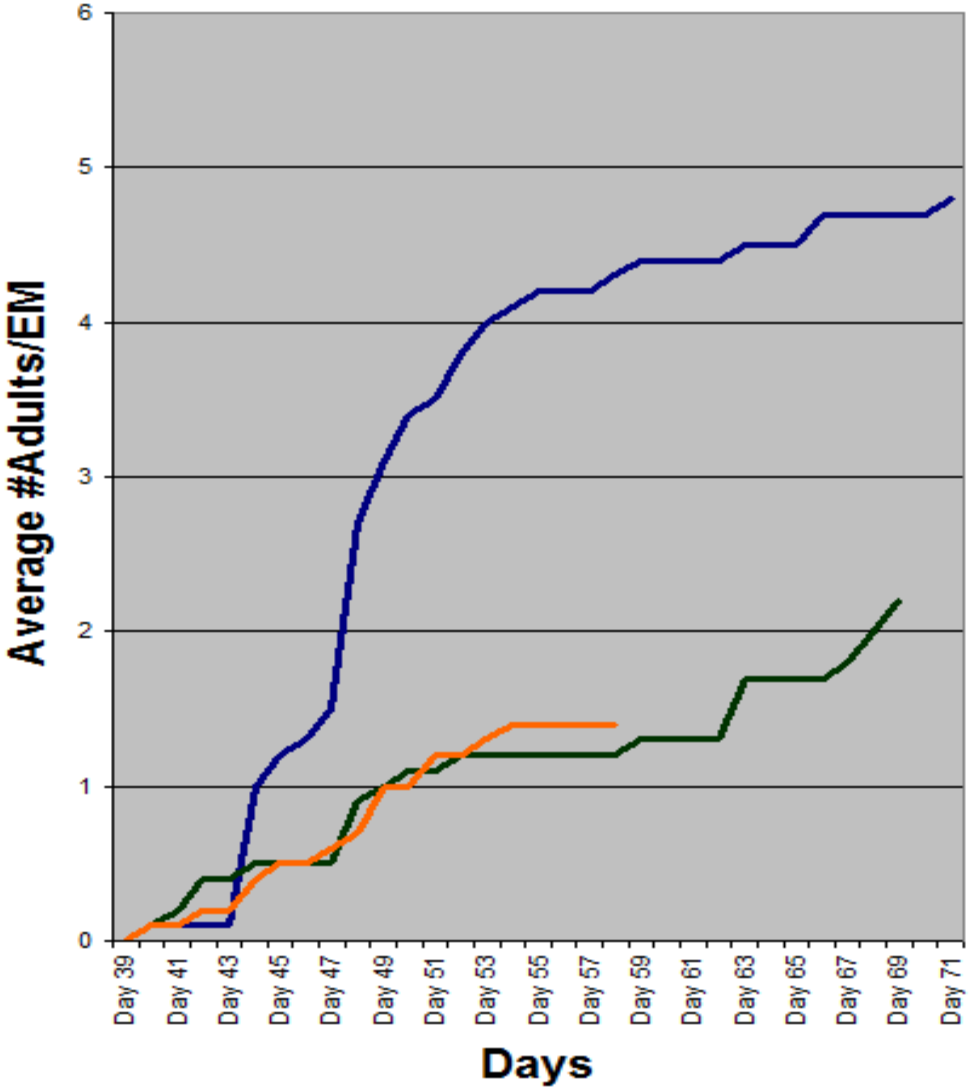
Results: Survival/Development Across Instars 1-5 (Control vs. Warm)




Control
Sterilized
Generation 1
Generation 2
Percentsurvival
100
80
60
40
20
0
*
**
1st instar
2nd instar
3rd instar
4th instar
Stink bug stage


Control
Sterilized
Generation 1
Generation 2
Days to developmental peak
70
60
50
40
30
20
10
0
*
**
na
1st instar
2nd instar
3rd instar
4th instar
5th instar
Adult
Stink bug stage

Results:
Adult eclosion rate by treatment



	Avg # Adults/ EM
Control	4.8
Warm	2.2
Hot	1.4

	Num DF	Den DF	F	*p*
Trt	2	26.7	.69	.5094
Day	74	1839	4.62	<.0001
DxT	131	1832	1.62	<.0001

Results: Adult eclosion rate by treatment

- Control: 68 days to peak of 48 adults
- Warm: 72 days to peak of 22 adults
- Hot: 58 days to peak of 14 adults

	DF	*p*
C vs. W	34.2	.0142
C vs. H	34.2	.0018
W vs. H	34.2	.4319

Conclusions

- Although there weren't significant differences in survivorship and development between C vs. W treatments until the adult stage, graphed data suggests a trend similar to that of the chemical sterilization results

- The high degree of variability in the data suggests that there are factors we aren't taking into account (such as location of egg mass on plant?)
  - Microclimate is likely playing an important role, but quantifying this is difficult

Conclusions (cont'd)

- Despite the variability, there was a significant interaction effect between treatment and time to peak adult production across treatments

- Dilip Venugopal's work has shown that on regional spatial scales, temperature is the driving force that influences BMSB population numbers
  - Does this just affect the stink bugs themselves or the symbionts that they rely on as well?

Unfinished work

- qPCR analysis of adults from 3 treatments to determine whether symbiont load is lower in W and H treatment

- Effects of humidity alone
  - Lower humidity negatively impacts the eggs and hatch rate (egg desiccation?)
- Effects of temperature alone
  - Higher temperatures don't affect hatch rate (to a certain point) but final adult counts differ

Questions?

Leske, 2010