

Examination of the effects of genotype clusters and endosymbionts on the ability of the pea aphid (*Acyrtosiphon pisum*) to transmit the PEMV virus and resist heat shock.



Catherine Wooster
Sanford Eigenbrode
Ying Wu



System:

Legumes, Aphids, Viruses

- Peas and lentils significant rotational crops in wheat here since the 1930's
- Pea aphids have been problematic pests in the system throughout this history...
- As direct pests and as vectors of viruses, *Pea enation mosaic* (PEMV)

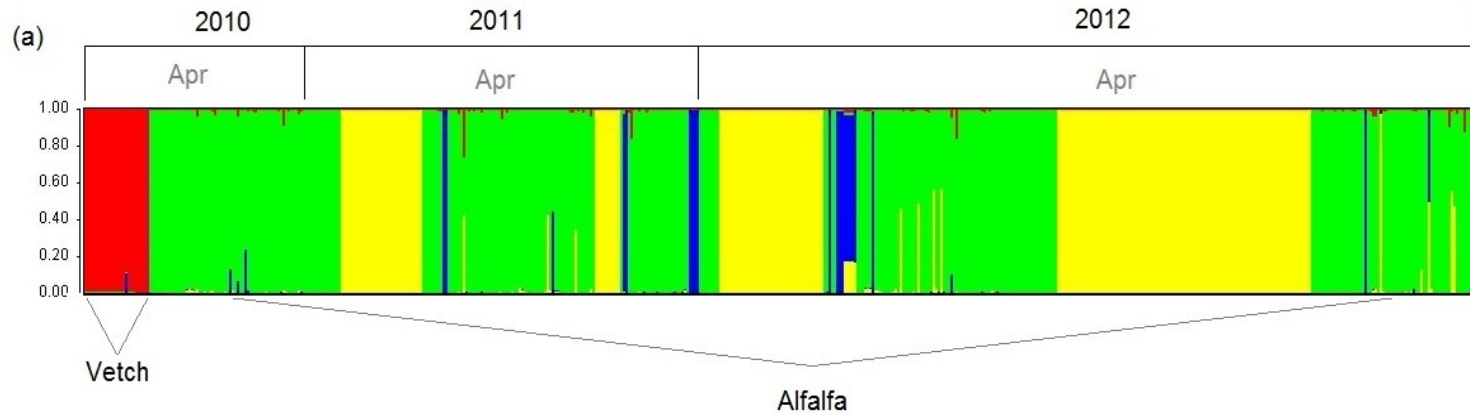




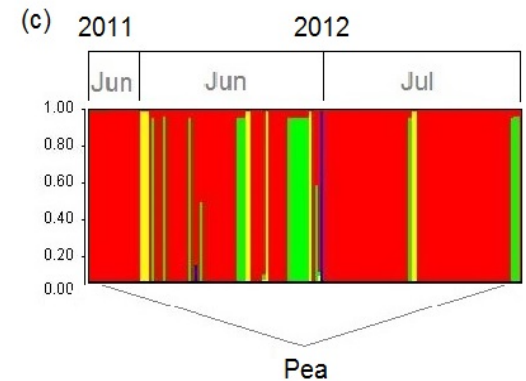
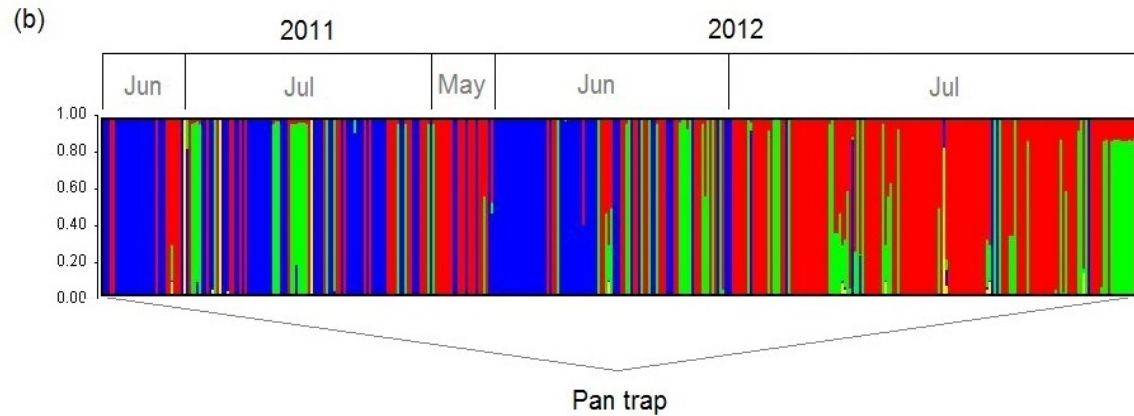
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Colonies and Genotyping

Columbia River Basin



Palouse



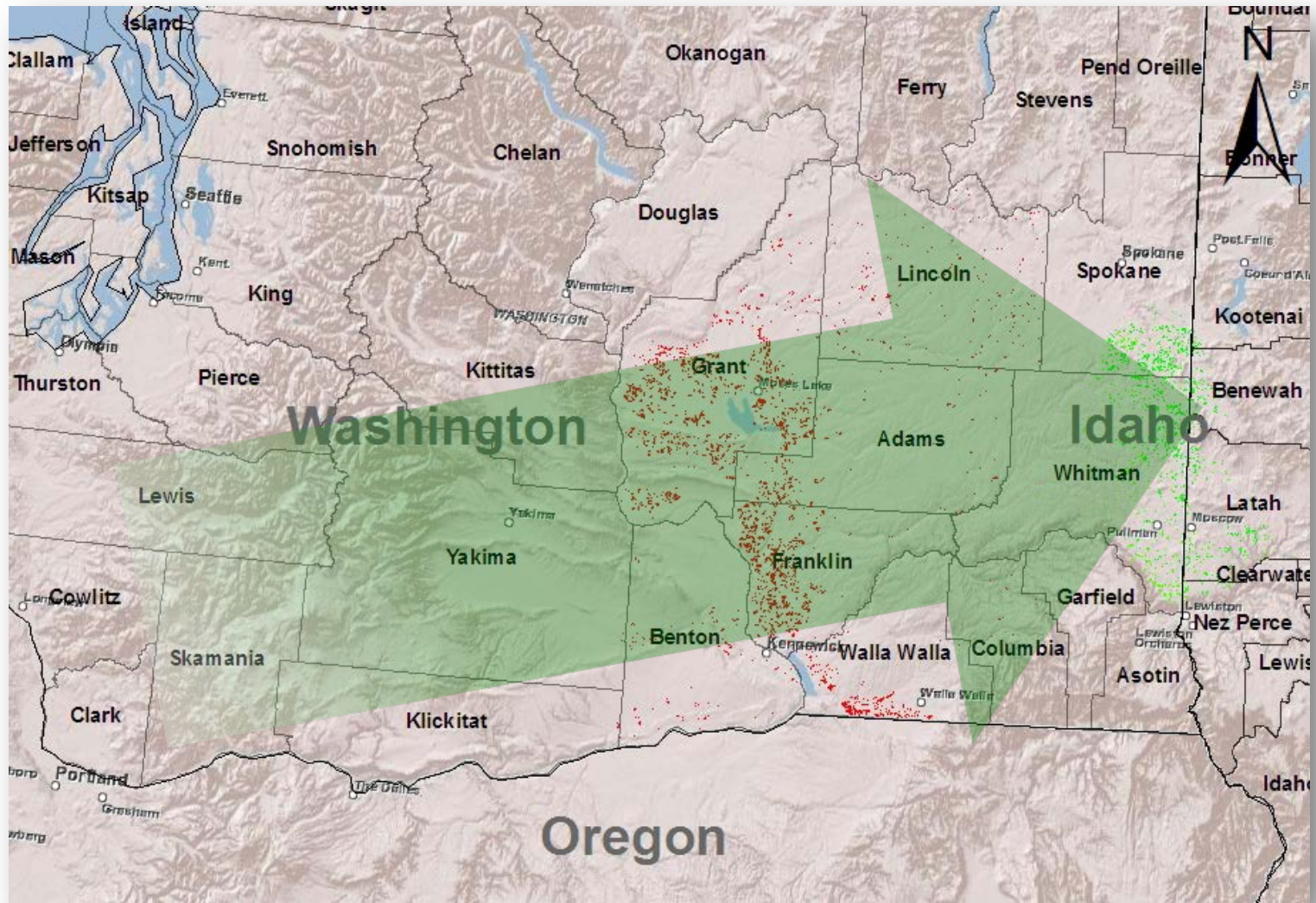


Table of Experimental Colonies

Colony	Origin	Host Affinity	Endosymbionts
Pea UI	Idaho Palouse	Pea	<i>Serratia symbiotica</i>
ALGR UI	Idaho Palouse	Alfalfa	<i>Hamiltonella defensa</i>
ALPK UI	Idaho Palouse	Alfalfa	<i>H. defensa</i> , <i>Rickettsia</i>
Pea O	Oregon	Pea	-
ALGR O	Oregon	Alfalfa	-
Red Clover	Oregon	Red Clover	-
Austin	Texas	Fava Bean	<i>Serratia symbiotica</i>
Austin Cure	Texas	Fava Bean	<i>Cured of S. symbiotica</i>
5A	Wisconsin	Alfalfa	<i>Naturally without endosymbionts</i>
5AT	Wisconsin	Alfalfa	<i>Hamiltonella defensa</i>

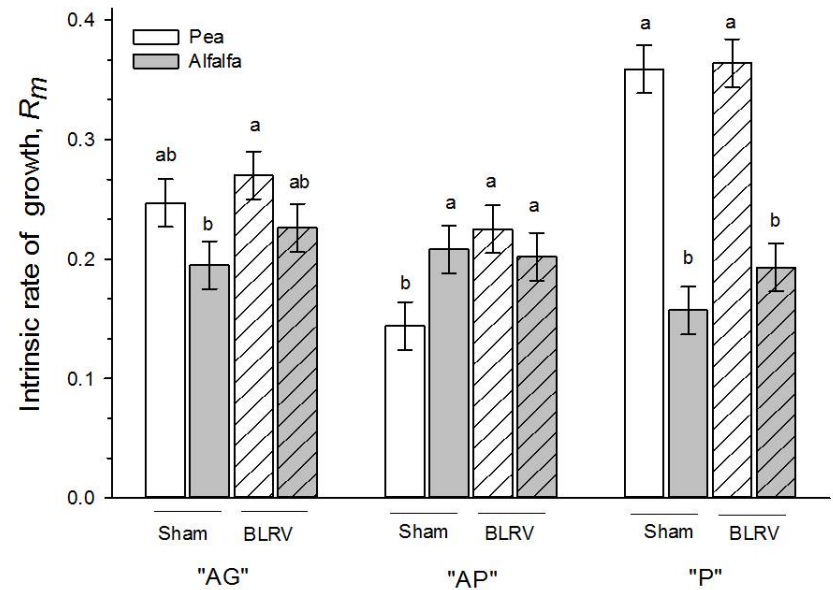
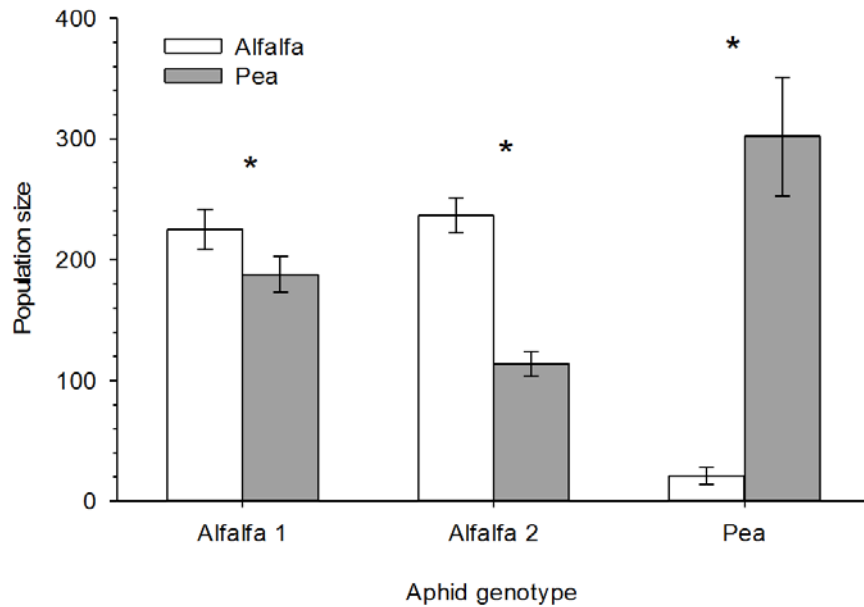


Core Questions

Virus transmission : Do all pea aphid genotypes transmit PEMV equally well?

Heat Shock: Do all pea aphid respond similarly to heat stress?

Aphids and Virus



- How does geographic location of aphid origin effect disease transmission across biotypes?
- How do aphid bacterial endosymbionts effect transmission of PEMV ?
- How does genetic variation in aphids affect the transmission and acquisition of PEMV?

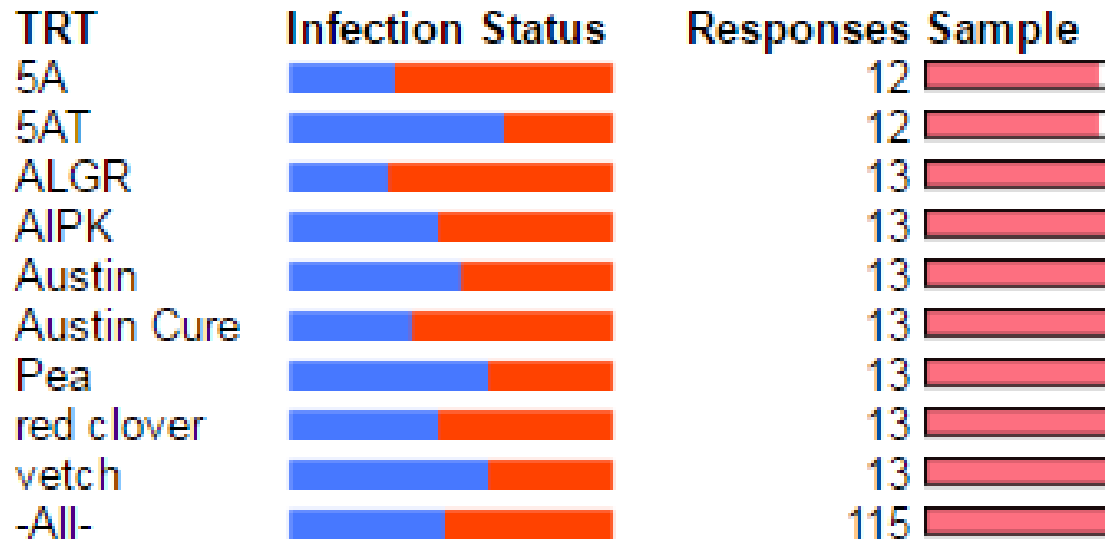
Other Virus Transmission Questions

Virus Transmission Methods

- Aphid reared in clip cages for on 72 hours on 2 PEMV infect source plants (PEMV infection was confirmed with Elisa (Enzyme-linked immunosorbent assay))
- A single aphid placed on a clean plant in a clip cage for 48 hours.
- 13 reps per biotype
- Infection confirmed with Elisa after 3 weeks.

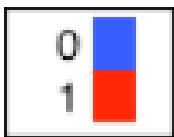
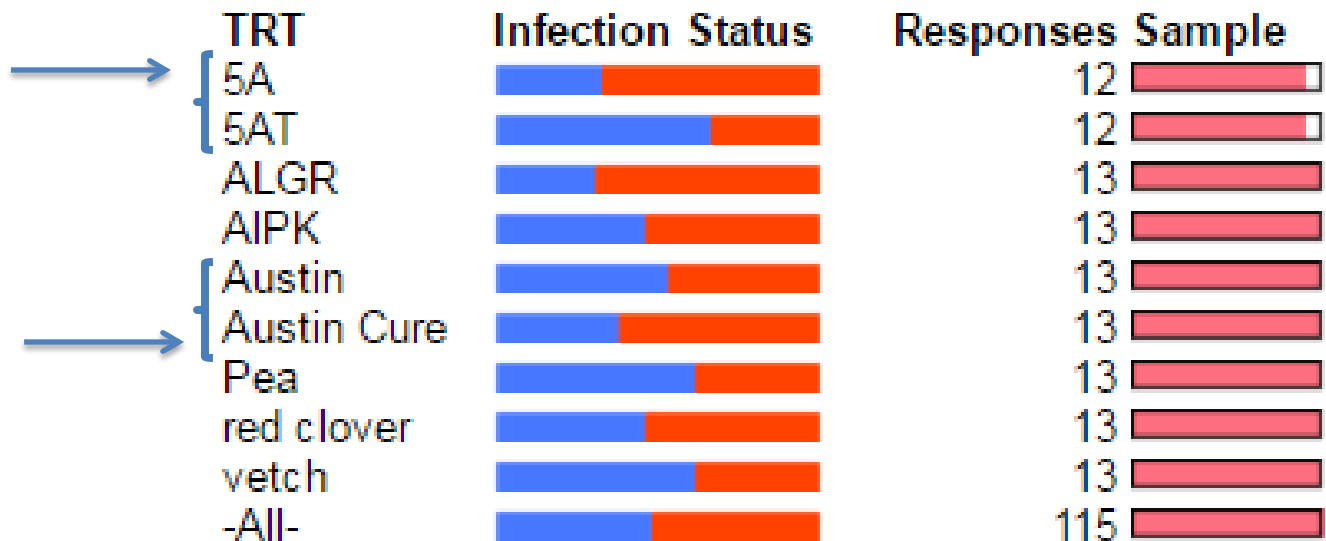


Results



Test Response Homogeneity

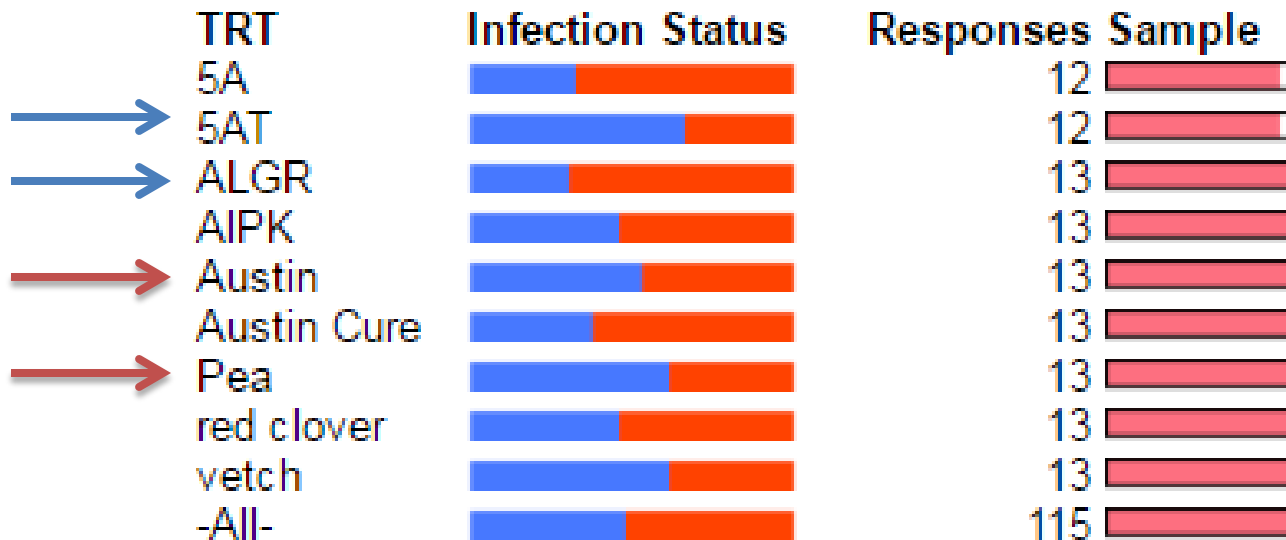
Test	ChiSquare	Prob>ChiSq
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Test Response Homogeneity

Test ChiSquare Prob>ChiSq

Results

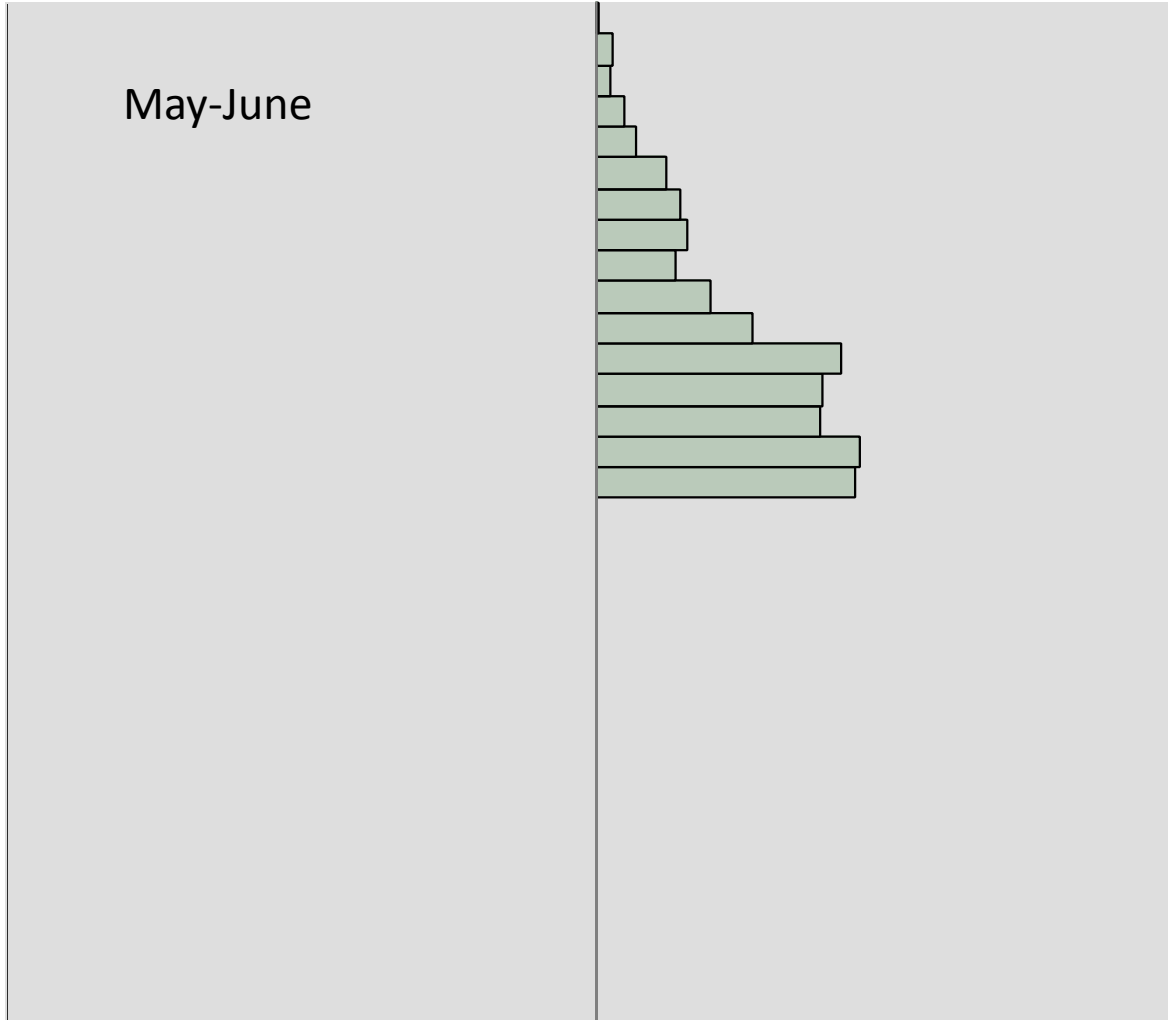


Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
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Heat Shock Experiment Background

MaxC vs. period



Other Heat Shock Questions

- How does geographic location of aphid origin effect survival during heat stress?
- How do bacterial endosymbionts effect response to heat stress?

Heat Shock Methods



- 20 aphids in their first several instars placed per clip cage
- 4 temperature treatments for 6 hours of 18°C (control) 32 ° C , 35 °C, and 37 °C
- 6 hours heat shock
- Survivorship measured

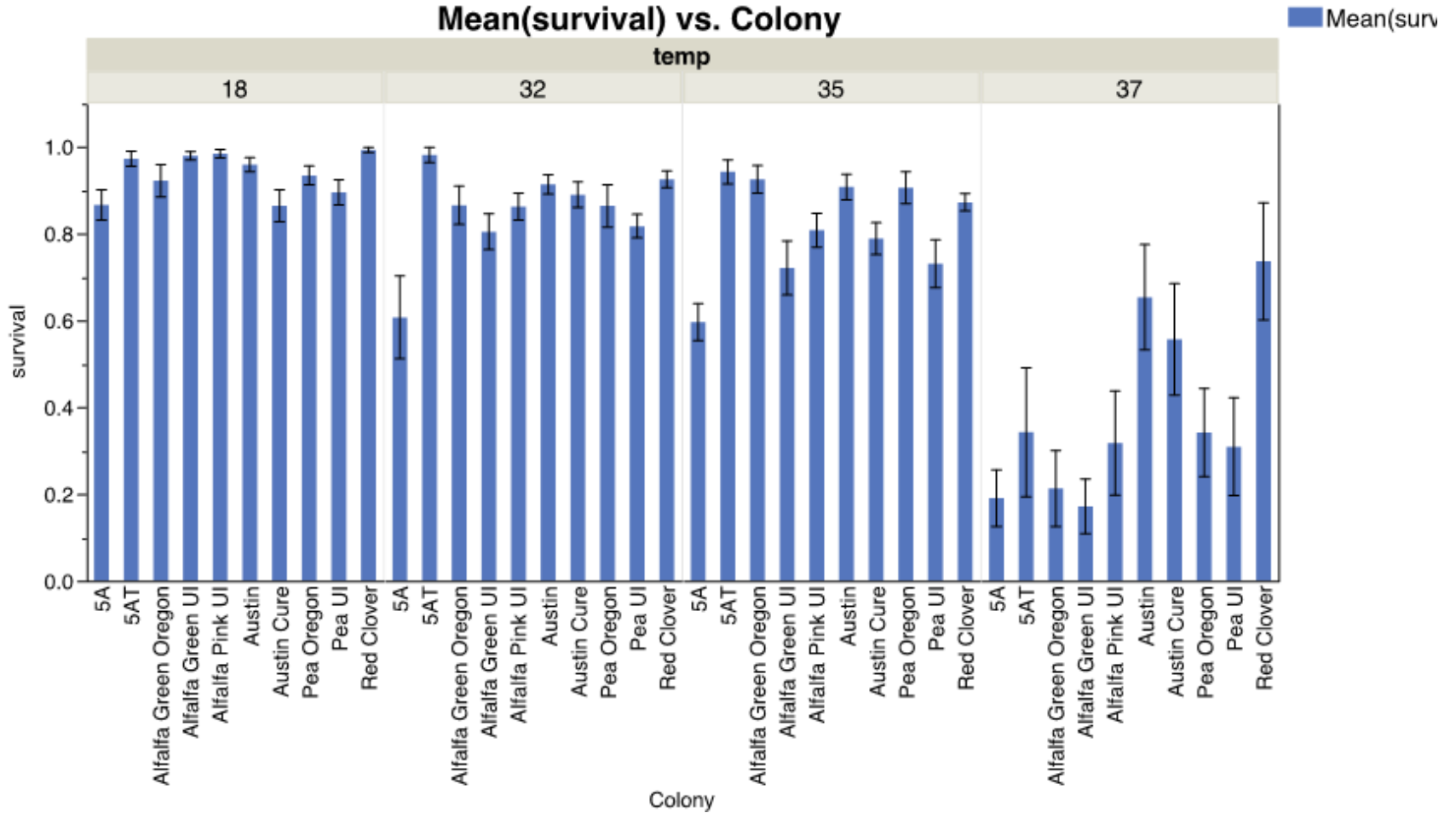
Results

F Ratio
3.9509
Prob > F
0.0004*

F Ratio
5.2135
Prob > F
<.0001*

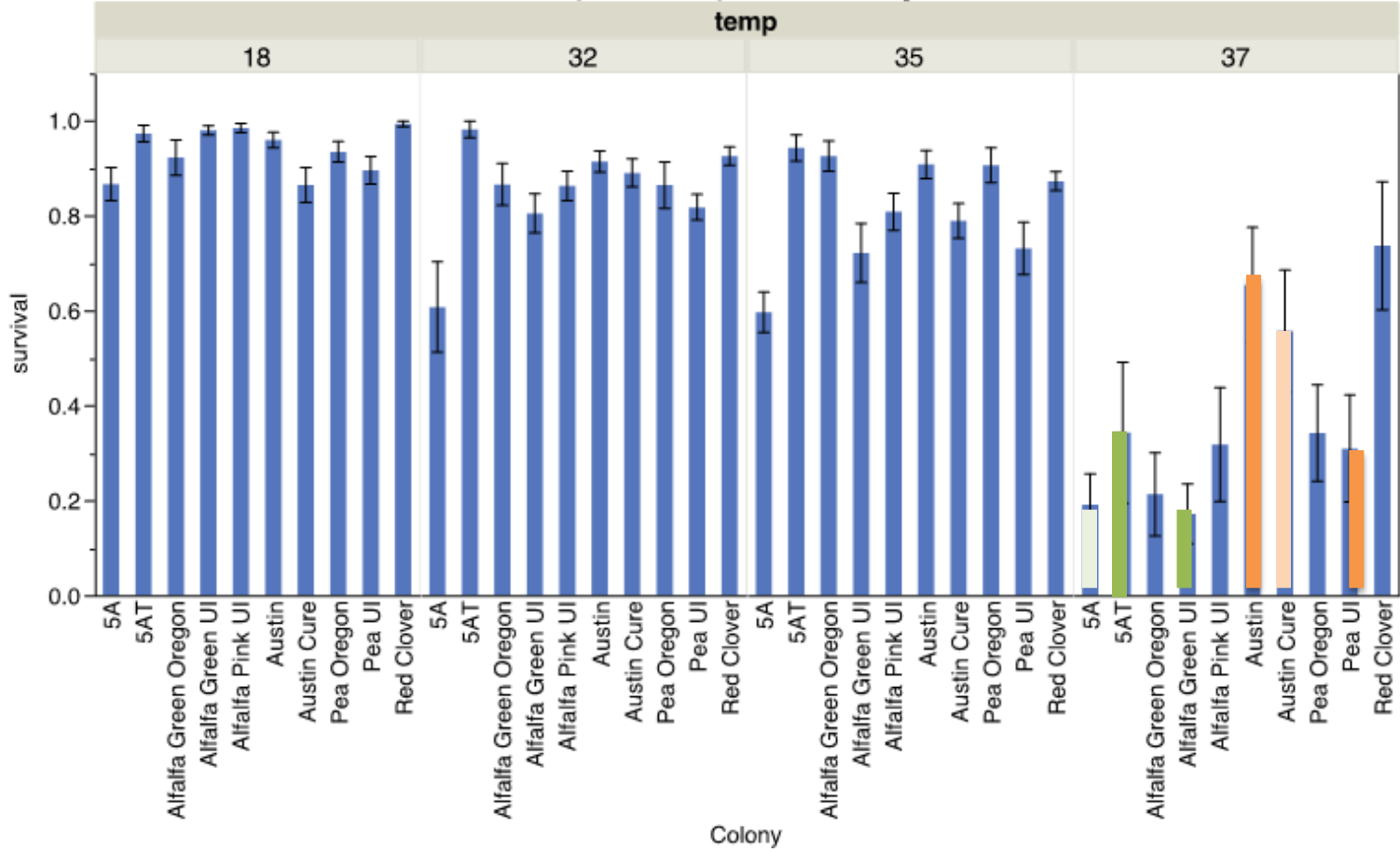
F Ratio
7.1188
Prob > F
<.0001*

F Ratio
3.1876
Prob > F
0.0027*

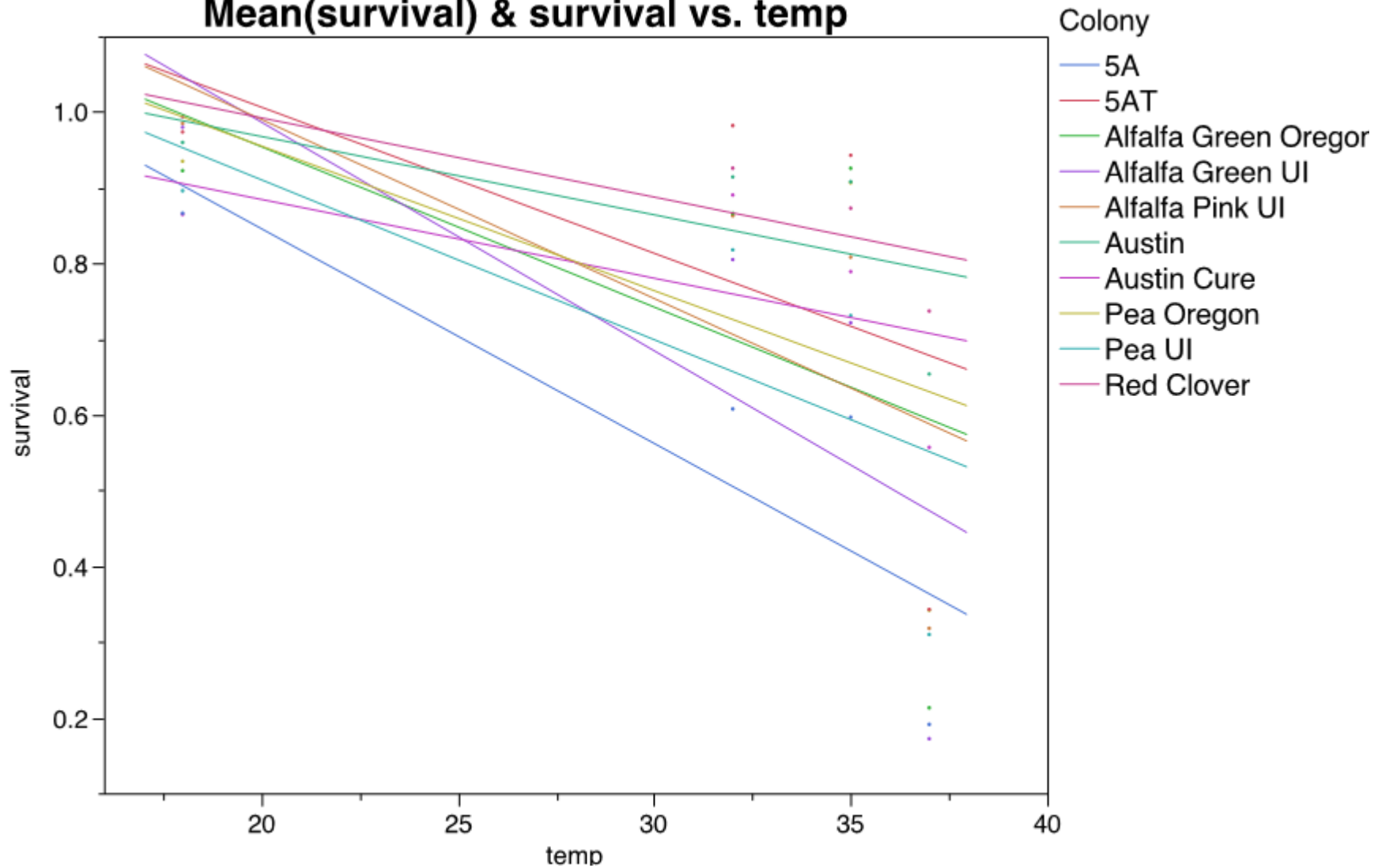


Mean(survival) vs. Colony

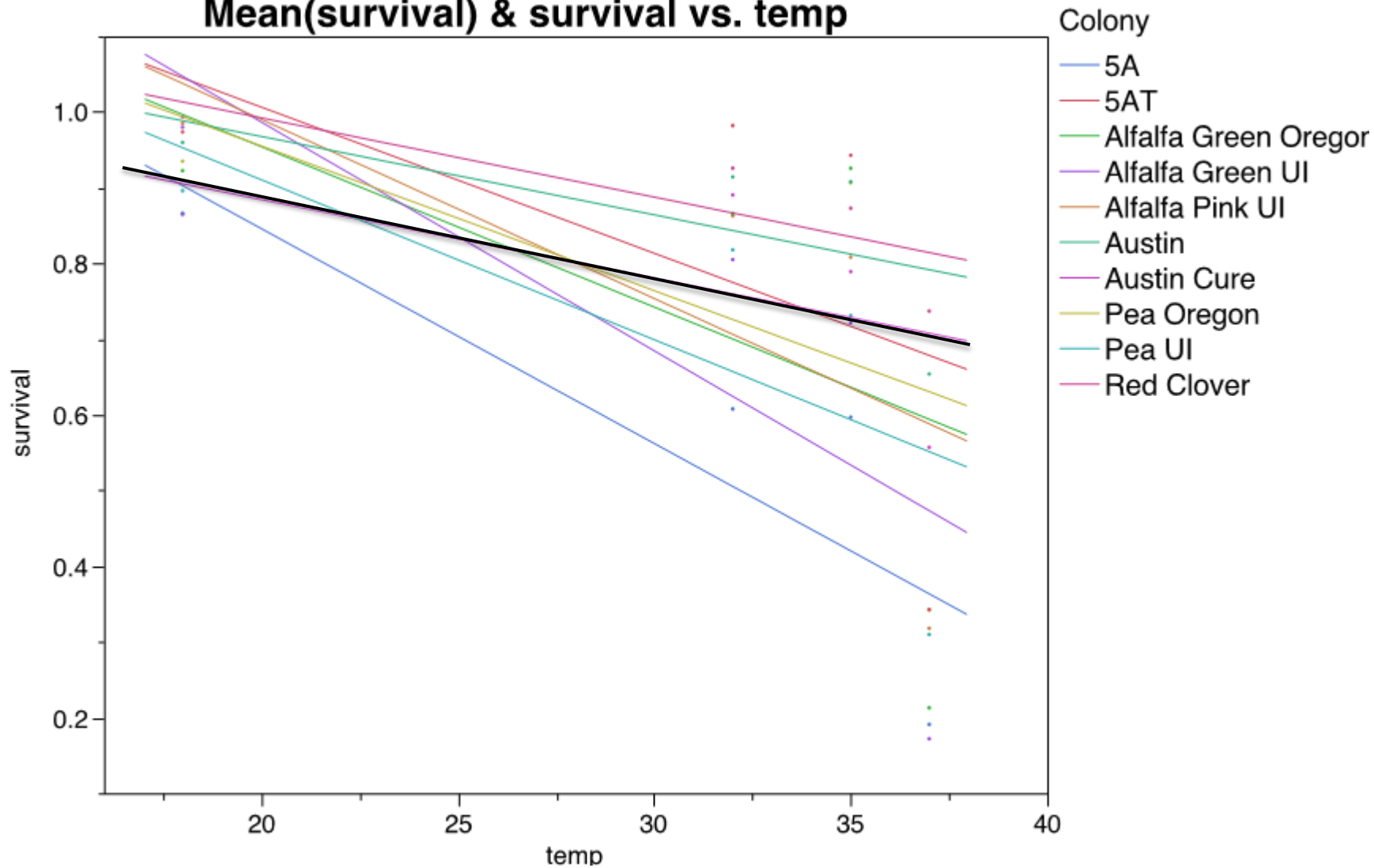
Mean(surv)



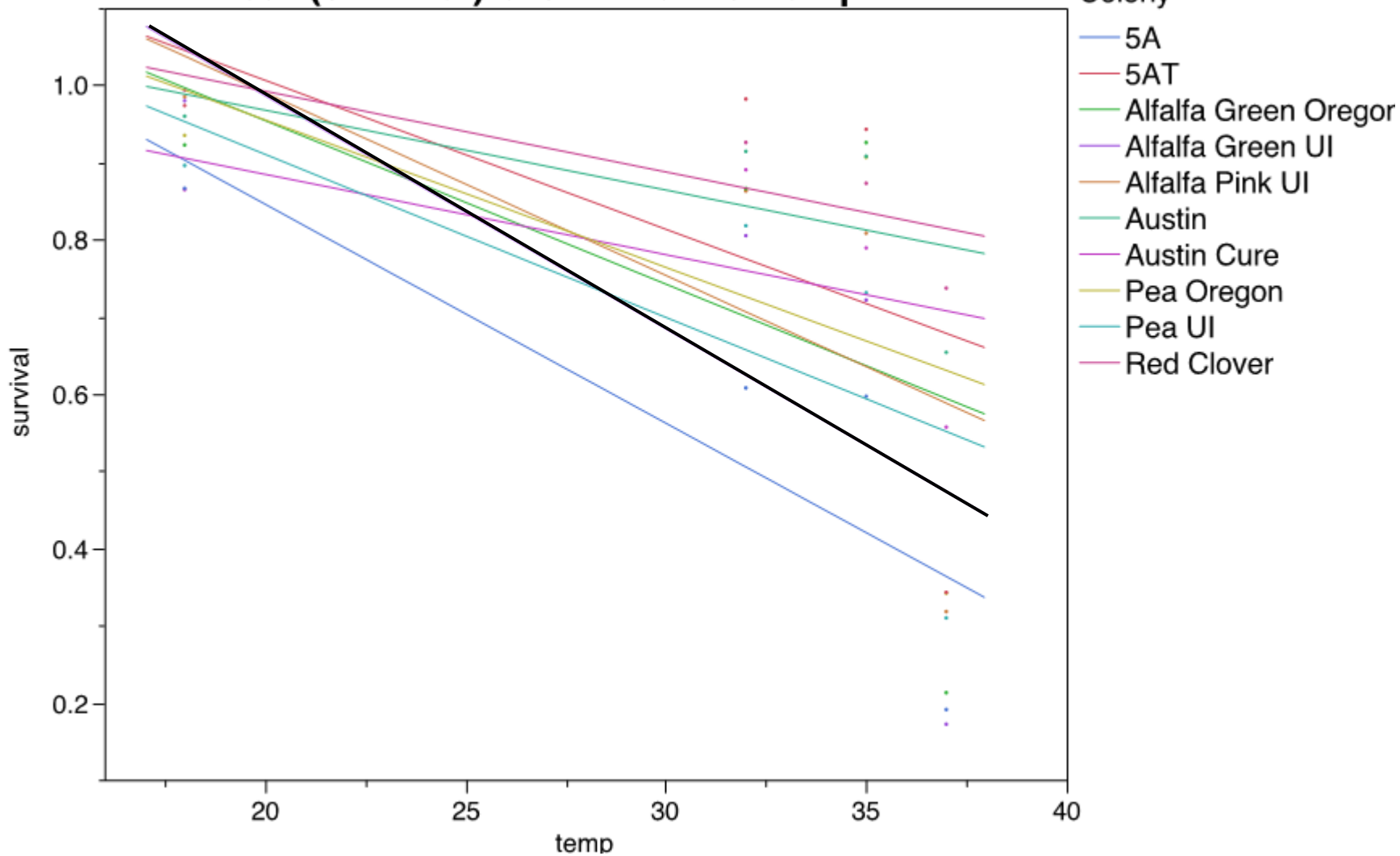
Mean(survival) & survival vs. temp



Mean(survival) & survival vs. temp



Mean(survival) & survival vs. temp



Conclusions

Virus Transmission

- No similarities found between same endosymbionts from different genotypes
- The relationship between viruses and bacterial endosymbionts should be investigated further

Heat shock

- Certain biotypes are more or less sensitive to heat shock treatments
- Geography between Idaho and Oregon had no statistical effect on survivorship
- No similarities found between same endosymbionts from different genotypes
- Aphids without endosymbionts were more affected by heat shock

Acknowledgments

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