Inter and intra-specific larval competition of two container breeding mosquitoes in South Texas

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Introduction

The recent spread of mosquito-borne diseases has highlighted the need for increased understanding of the distribution and biology of potential vector species. Most recently, local transmission of Zika virus in South Texas has been observed, joining locally transmitted diseases such as Chikungunya and dengue viruses[1]. We explored the potential intra- and inter-specific larval competition between two vector species. Increased understanding of the larval interaction may enhance control and surveillance efforts.

Materials & Methods

Field collected *Aedes aegypti* and *Aedes albopictus* were reared in laboratory conditions to an F2 generation. All experiments were repeated at typical "summer" (~30°C) and "winter" (~15°C) temperatures. Survivorship was measured by counting emerged adults.

Experiment 1: Interspecific Competition

Twenty larvae were reared in high food environments at the following interspecific densities: 0:20, 5:15, 10:10, 15:5, and 20:0 (*Ae. aegypti:Ae. albopictus*), twenty replicates per treatment.

Experiment 2: Intraspecific Competition

Larvae were reared in single species habitats in densities of either 10 or 20 larvae, with either high or low food availability, ten replicates per treatment..

Results & Discussion

Species, density, food, and temperature were included in all statistical analyses. Non-significant interactions were removed from the model. One replicate from experiment one was removed due to experimental error. All statistical analysis was conducted with JMP version 13[2].

Experiment One

The varying starting densities of each mosquito species did not influence the survivorship of either hetero- or con-specifics ($p > 0.05$). However, temperature did significantly influence survivorship of both species ($p < 0.0001$, figure 1). In addition, *Ae. aegypti* had an overall lower survivorship than *Ae. albopictus*, regardless of temperature ($p < 0.0001$). There was no interaction between species type and temperature ($p < 0.05$

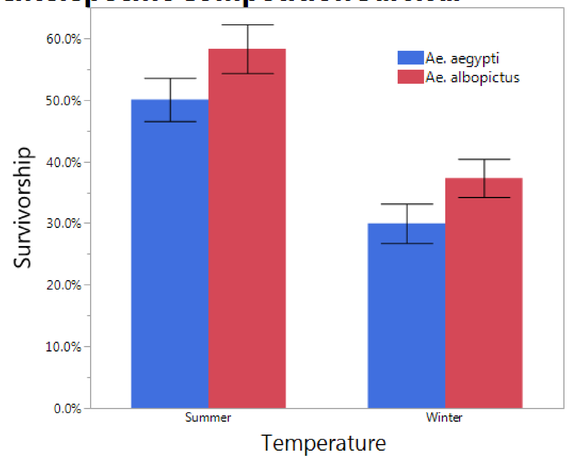
Experiment Two

In this experiment, there were a large number of significant ($p < 0.05$) factors and interactions, including temperature ($p < 0.0001$), food ($p = 0.0002$), and species ($p = 0.0013$). Significant interactions included starting density and temperature ($p = 0.0049$), temperature and food ($p < 0.0001$), and temperature and species ($p = 0.0013$). In regards to the temperature and species effect, they were the same as observed in experiment one, although there was non-significant difference in survivorship the two species in the summer months. In all cases, high food availability resulted in lower survivorship.

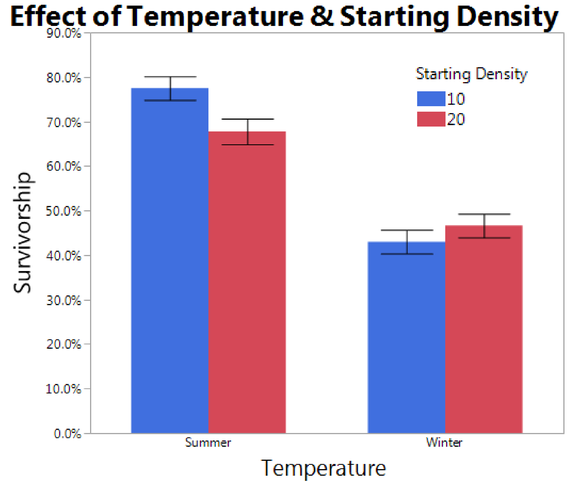
The most interesting effect in experiment 2 was the significant interaction between temperature and the starting density. In the summer, survivorship was increased in lower densities, while they were not significantly different from each other in the winter temperatures (figure 2).

Error bars in the figures are plus/minus one standard error.

Interspecific Competition Survival



Effect of Temperature & Starting Density



Conclusions

This research represents preliminary studies to explain previously observed patterns in temporal and geographic abundance of the two vector species[3,4]. Preliminary conclusions are below.

- In experiment 2, high food levels resulted in decreased survivorship, suggesting food levels were too high and may have polluted the water.
- Neither species appeared to be significantly influenced by the presence of con-specifics, results not found in previous studies.
- Temperature play a large role in survivorship, with high levels during extremely hot summer months.
- Complex interactions involving starting densities, resource availability, and environmental effects still remain to be identified.

Further research

Further analysis of the data is underway for the potential influence of competition on development time and size at emergence. Our goal is to explain observed patterns of abundance of both mosquito species that occur geographically and temporally. Additional research on the individual vector-competence of these local populations of mosquitoes is planned.

References

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