Voracity in Desert and Urban Black Widow Spiders subjected to ALAN treatment

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Introduction

- ALAN, or Artificial Light at Night, is a form of light pollution that has increased due to urbanization and population growth [1].
- ALAN can be disorienting and lead to changes in foraging, competition and predation [2].
- Light pollution has been found to cause developmental issues in certain spiders [3].
- Voracity, or aggression toward prey, in Black Widow spiders *(Latrodectus hesperus)* can be measured by how quickly a spider responds to a prey stimulus.
- It was predicted there would be greater voracity in black widow spiders subjected to ALAN treatment compared to voracity before treatment.

Methodology

- In total, 22 Black Widow Spiders were collected from 2 Sonoran desert sites on 4/22/22 and 4 urban Phoenix sites on 3/27/22.
- Voracity was tested bi-weekly using 3 treatments: artificial prey vibration test pre-feeding, live prey cricket test, and artificial prey vibration test post-feeding. Spiders were weighed after each artificial prey vibration test.
- Prey vibration device used was a generic electric toothbrush. Other studies have employed similar vibration devices to test spider voracity [4].
- The electric toothbrush was set to its massage setting. A 4 inch wooden stick was secured to the end of the toothbrush and used to contact the web about 5-6 cm away from the spider.
- Live prey tests involved the use of crickets held against the web about 5-6 cm away from the spider. Spiders were only fed during live prey tests.
- A maximum response time of 300 seconds was used to measure voracity of black widow spiders. Time was stopped and recorded when spiders began to throw web at the stimulus.
- ALAN treatment was set to an 8:16 reverse photoperiod with 8 hours of nighttime light (~1.7 lx) and 16 hours of daytime light (~1000-3000 lx).
- A natural light room was set to 8:16 reverse photoperiod with 8 hours of complete darkness (0 lx) and 16 hours of daytime light (~1000-3000 lx).

Results

- Desert spiders, relative to urban spiders, were significantly quicker to attack both artificial prey and live prey vibrations (**Figure 1**: p<.01).
  - However, when we tested their voracity response a day after feeding, we found that this habitat difference no longer existed (**Figure 1**: p=0.1).
- We found no difference between a spider's (urban or desert) voracity towards an artificial prey vibration (electric toothbrush) and a live prey vibration (p=0.5).
- Spider body mass was a poor predictor of voracity towards artificial prey (**Figure 2**: r2=.16) and live prey (**Figure 3**: r2=.14).
- We found no difference between urban and desert spider mass at any stage in the experiment (p>0.1).

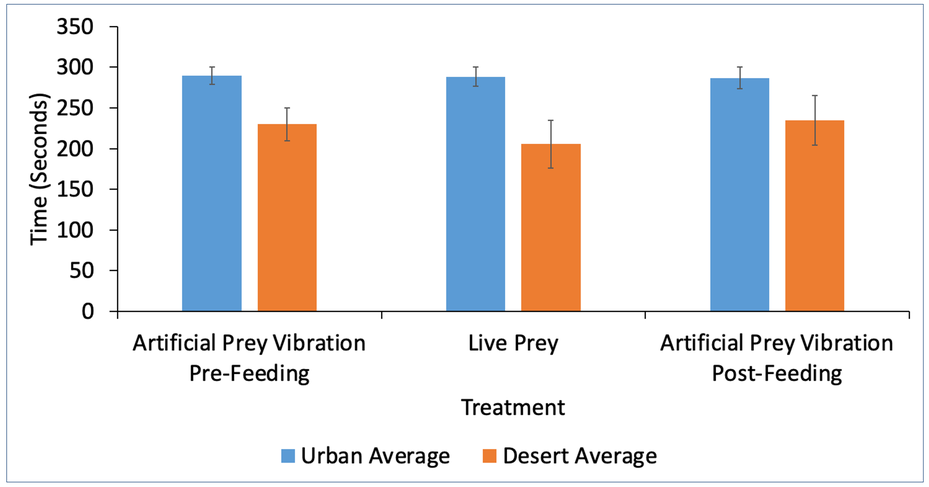

Figure 1: Average voracity response time in Urban and Desert Black Widow Spiders per treatment.

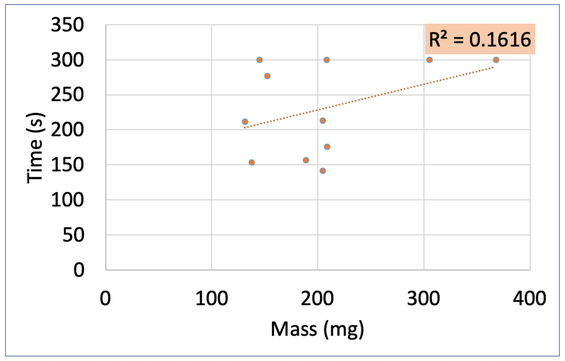

Figure 2: Artificial Prey Vibration Pre-Feeding Voracity VS Mass.

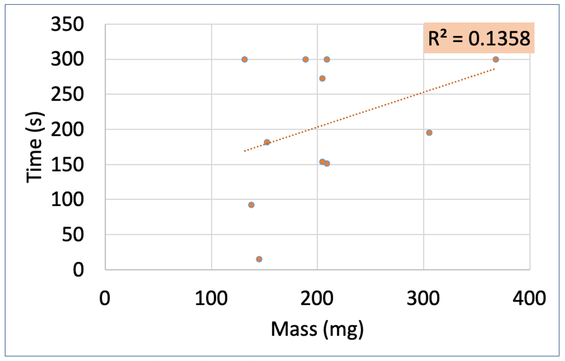

Figure 3: Live Prey Voracity VS Mass.

Conclusion

- Desert Black Widow spiders showed higher voracity toward prey stimulus than urban spiders indicating urbanization may have an impact on behavior.
- Voracity in desert populations decreased following live prey captures, suggesting a link between hunger and voracity.
- No correlation was found between mass and voracity.
- The impact of urbanization and human disturbances may decrease risk taking behavior while foraging, thereby reducing voracity [5].
- Further investigation is necessary to fully establish and confirm causative factors of the correlation between urbanization and voracity.
- Research on the effects of ALAN on spider voracity are still being conducted.

Acknowledgements

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