The Effects of Sexual Dimorphism on Toxic Prey Avoidance in the Chinese Praying Mantis, *Tenodera sinensis*

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Introduction

- This experiment strives to investigate if sex based behaviors in praying mantid feeding habits hold true when sexual dimorphism is not obvious in juvenile mantids
- Sensitivity to bitter tastes provides an important means for animals to detect various toxic compounds in food (Wooding *et al.* 2006).
- In predators, taste sensitivity also allows animals to exploit nutritious but toxic food sources by monitoring the consumption of compounds that may cause illness or death (Wooding *et al.* 2006).
- Studies on the Chinese praying mantis, *Tenodera sinensis,* show that the mantids will wipe their mouths, shake, and reject bitter tasting toxic prey when it is encountered (Carle *et al.* 2015).
- Adult male mantids were found to have a more exaggerated response, lower level of acceptance, and reduced consumption of bitter prey compared to females who have higher nutritional requirements due to their larger bodies and reproductive cycles (Carle *et al.* 2015).
- A difference in juvenile mantid feeding behavior based on sex has not been observed (Paradise and Stamp, 1991)

Materials and Methods

Hatching
- Incubate eggs at 24°C. Wait 2-8 weeks
- Separate mantids within 48 hours of hatching

Feeding
- Feed the mantids three flies three times a week
- Give them spring water on cotton balls every two days

Random Assignment
- Once the mantids reach their second instar, randomly place 45 mantids into two groups
- One group will be the 50 mM quinine group, and one will be the 500 mM quinine group

Experimental treatment
- Feed the 50 mM group a water coated control fruit fly on the first day and on the second day feed them a fruit fly coated in 50 mM concentration quinine
- Feed the 500 mM group a fly coated in 500 mM concentration quinine on the first day and a water coated fly on the second day

Treatment specifics
- The experiment will continue for a duration of 14 days with alternating days of the control and the quinine coated wingless fruit flies

Results
- Record the number of bitter and water coated flies consumed and the observed feeding behaviors
- Then calculate the avoidance index which is the total number of bitter flies consumed divided by the total number of bitter and water coated flies consumed

0 mM and 50 mM concentration

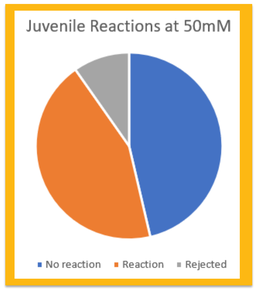


Figure 1. Ethogram showing the activity happening during the feeding time for 50 mM concentration

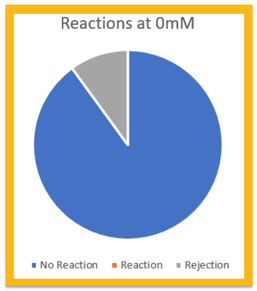


Figure 2. Ethogram showing the activity happening during the feeding time for 0 mM concentration

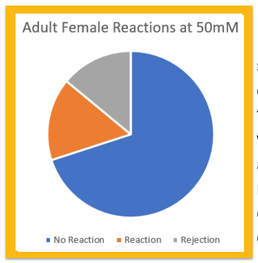


Figure 3. Ethogram showing our expected results for how females would react as adults at the 50 mM concentration of quinine

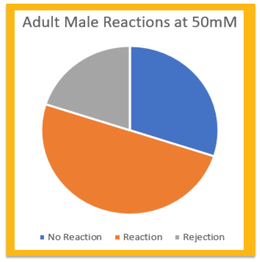


Figure 4. Ethogram showing our expected results for how males would react as adults at the 50 mM concentration of quinine

- Females reacted 22% of the time while males reacted 50% of the time when given the 50mM concentration of quinine

500 mM concentration

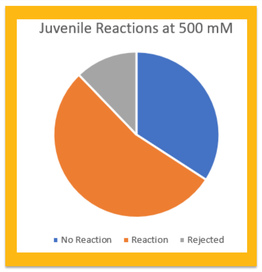


Figure 5. Ethogram showing the activity happening during the feeding time for 500 mM concentration .

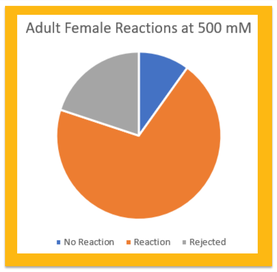


Figure 6. Ethogram showing our expected results for how females would react as adults at the 500 mM concentration of quinine

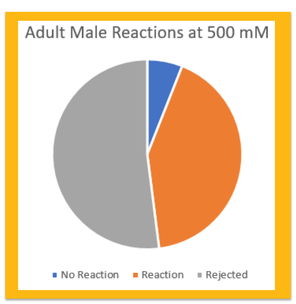
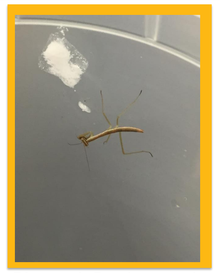
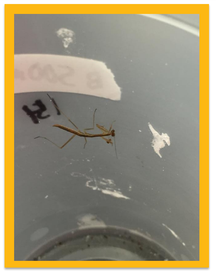


Figure 7. Ethogram showing our expected results for how females would react as adults at the 500 mM concentration of quinine

- With the 500 mM concentration the females reacted 68% of the time and rejected the flies 23% while the males reacted 45% of the time but rejected the flies at 52%.



Picture 1. Praying mantis having no reaction



Picture 2. Praying mantis reacting to bitter taste

Picture 3. Praying mantis during the first trial

Food choice predicts sexual dimorphism

- The predicted results are the praying mantids would have more reactions and rejections with the 500 mM concentration group than the 50 mM concentration group
- It is anticipated the mantids would react more frequently to the bitter taste in the 50mM trial and still eat the prey while in the 500mM trial the mantids would reject the flies and not eat them at all
- This outcome would be expected because the 500 mM concentration of Quinine was the more bitter tasting one
- Individuals within this study would have different reactions to the bitter taste and frequently reject the flies or react to the bitter taste, which could be from sexual dimorphism
- Once the individuals could be sexed, the hypothesis could beconfirmed in that females were more willing to eat bitter prey than males
- This would match up with the results from Carle *et al.* 2015. They found that adult male mantids are more sensitive to bitter taste than the adult female mantids

Future Directions

- Unfortunately, our praying mantids did not hatch so all of the above data is speculative data based upon our pilot study we did during Spring 2018
- To continue this research, we would repeat the pilot study starting our trials during the mantid's third instar and sex them once they were in their 5th instar

Literature Cited

Carle, T., Yamashita, T., & Yamawaki, Y. (2015). Aversion for bitter taste reveals sexual differences in alimentation strategies in a praying mantis. *Animal behaviour*, *106*, 79-87.

Paradise, C. J., & Stamp, N. E. (1991). Prey recognition time of praying mantids (Dictyoptera: Mantidae) and consequent survivorship of unpalatable prey (Hemiptera: Lygaeidae). *Journal of Insect Behavior*, *4*(3), 265-273.

Wooding, S., Bufe, B., & Grassi, C. (2006). Independent evolution of bitter-taste sensitivity in humans and chimpanzees. *Nature International Journal of Science, 440*, 930-934.

Paradise, C. J., & Stamp, N. E. (1990). Variable quantities of toxic diet cause different degrees of compensatory and inhibitory responses by juvenile praying mantids. *Entomologia experimentalis et applicata*, *55*(3), 213-222.