"Survival of the bitterest"

Praying mantids can taste bitter substances, but they may not find them aversive

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Introduction

Taste perception gives predators valuable information about the nutritional content and toxicity of prey prior to ingestion. Although much is known about the visual system of praying mantids, and how they make predatory decisions based on visual information, we know little about their gustatory abilities. To the best of our knowledge, this is the first attempt to assess the taste sensitivity of praying mantis to bitter and sweet compounds. We expected that prey defended with higher concentrations of bitter substances would be more likely to be rejected and survive attack.

Methods

Subjects

- 8 male and 7 female captive bred Giant Asian Mantids (*Hierodula membranacea*)
- Subjects were housed in individual tanks (46 x 30 x 17 cm) with environmental enrichment of wooden perches and leaves.

Taste Trials

In a series of taste trials the mantids were presented with a range of concentrations of both bitter (quinine and denatonium) and sweet (sucrose and glucose) solutions.

Individuals were placed into a testing arena and left to settle, after this period they were fed a 2µl drop of the appropriate solution using a Gilmont syringe. The following observation period was 3 minutes in which the total duration of mouthpart activity was recorded. A 70 minute gap was left between trials for the bitter solutions and 60 minute gap for the sweet.

Using the same protocol we also tested the effect of viscosity on mouthpart activity. Distilled water was thickened using varying concentrations of Carboxymethyl cellulose (CMC), and then presented to the mantids. This was to ensure that viscosity was not affecting our results.

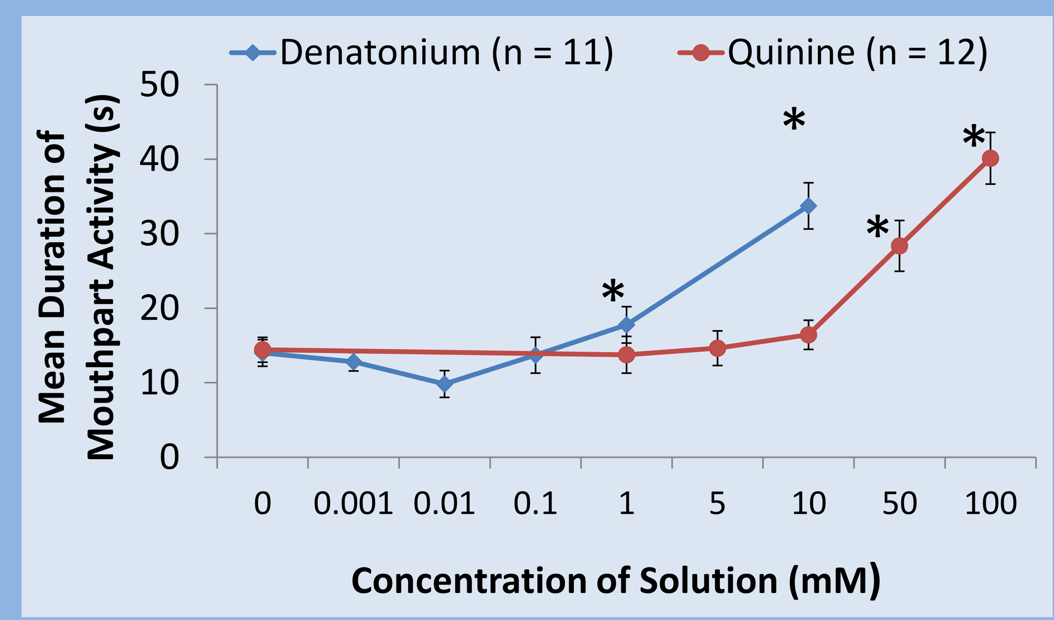
Prey Rejection

Mealworms (*Tenebirio molitor*) were injected with 0.04ml of 100mM quinine, and then 7 were presented to 2 mantids over one week. Trials were recorded to document rejection behaviour.

Results

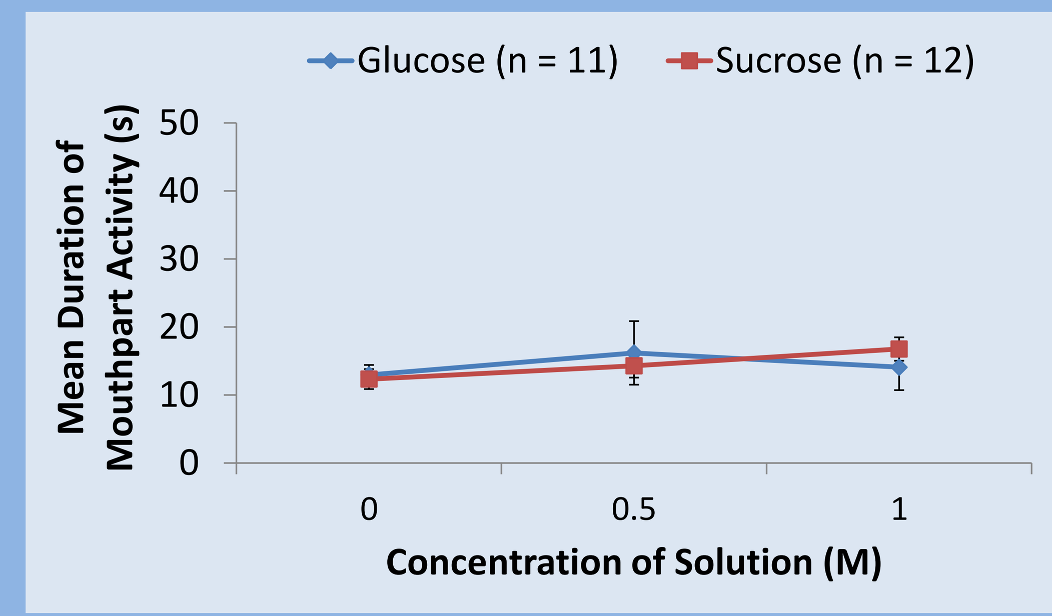
Significantly more mouthpart activity was displayed after drinking the higher concentrations of quinine and denatonium compared to after drinking water. However, glucose, sucrose and solutions more viscous than water did not elicit significantly more mouthpart activity than water. Despite detecting quinine, the mantids showed no aversion to quinine defended mealworms (see below).

Bitter

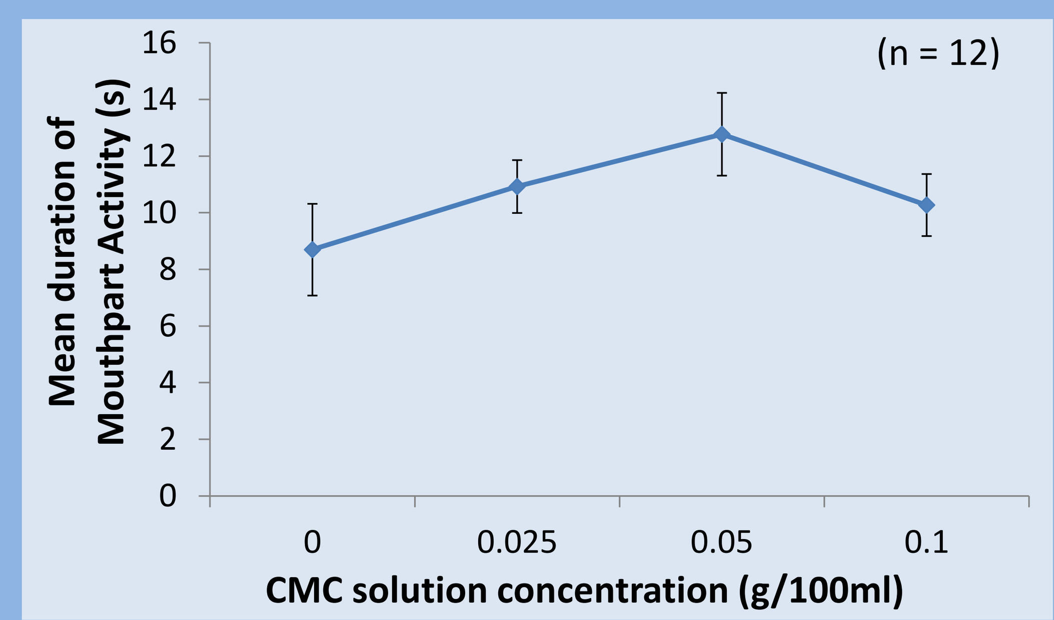


*= Significantly different from water (Paired T-test $p < 0.05$)

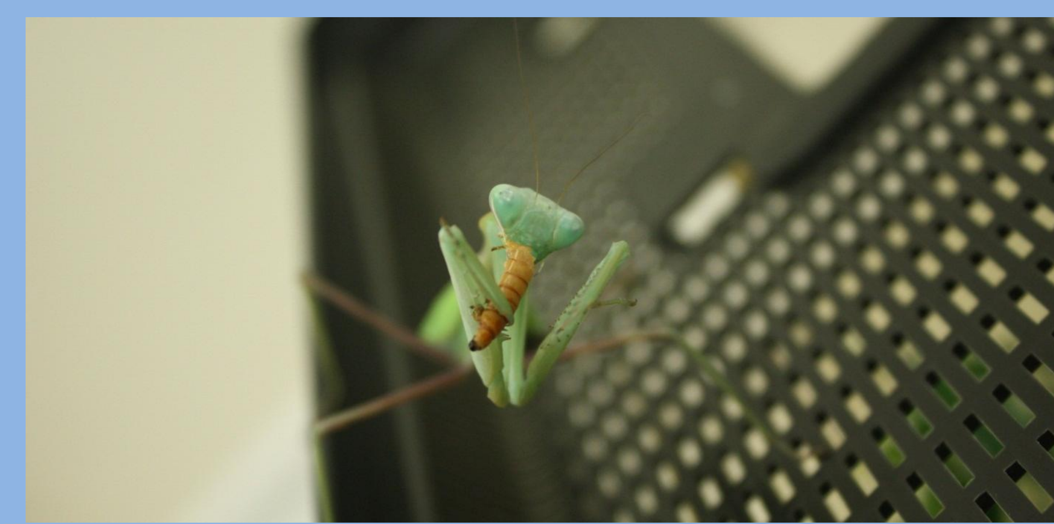
Sweet



Viscosity



Prey Rejection



Picture showing a female mantis eating her 7th mealworm filled with 0.04ml of 100mM quinine solution. The mantids showed no aversion to the defended prey.

Conclusion

Mouthpart activity suggests that the mantids detect bitter compounds, however, there appears to be some variation in their responses to different bitter stimuli. Despite having an ability to detect bitter substances, the mantids seemed to ignore the artificial prey defence. This raises some questions about how toxicity initially evolved, if simply being distasteful isn't effective against some predators.

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