Predator Avoidance Behaviors of *Physella acuta*

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Introduction

The senses of prey animals have been finely tuned by natural selection to detect potential predators before a predation attempt.

For aquatic invertebrates, chemosensation is the primary means of predator detection[1].

Known predators the likes of crayfish[2] and the giant water bug[4] actively seek and prefer aquatic invertebrates such as freshwater snails.

The freshwater snail may be able to sense predators before a predation attempt, and thus may show antipredatory behaviors.

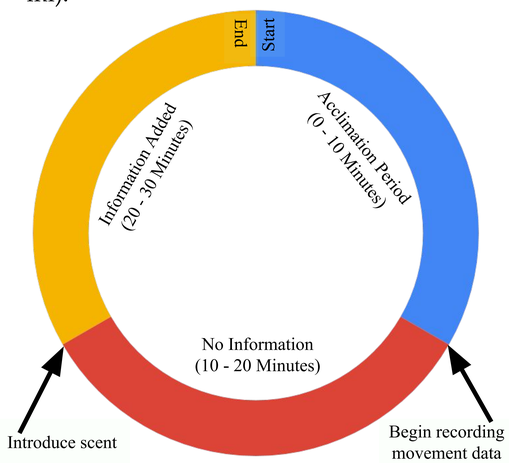
Objective

Investigate predator avoidance behavior of *Physella acuta*, a freshwater snail, exposed to two predators' scent (giant water bug, crayfish[3]), scent of a distressed conspecific, and a control in a test tank.

Methods

Physella acuta were observed and recorded in isolation for a period of thirty minutes.

Predator scent was created by crushing a single predators (0.75 g) and mixing with water (50 ml).



Videos were transcribed (Fig. 1) with ImageJ and *P. acuta* tracks were digitally measured.

Before and after distances were compared with one-sample t-tests (mu = 0).

Results

We observed and recorded a total of 20 snails subdivided into 5 types of experimentation: 5 trials each of *Procambarus clarkii* (crayfish), *Lethocerus americanus* (giant water bug), a distressed conspecific, and water from the habitat (control).

The average distance tracked by *Physella acuta* before the introduction of scent was 482.12mm (± 122.06 SD) for giant water bug trials, 723.63mm (± 45.57 SD) for crayfish trials, 587.00mm (± 137.02 SD) for distressed conspecific trials, and 514.83mm (± 133.74 SD) for water from the habitat (control).

The average distance tracked by *Physella acuta* after the introduction of scent was 465.80mm (± 58.39 SD) for giant water bug trials, 625.15mm (± 77.65 SD) for crayfish trials, 542.48mm (± 212.87 SD) for distressed conspecific trials, and 510.73mm (± 216.24 SD) for water from the habitat (control).

Statistical analysis revealed that only the crayfish scent resulted in a significant change in behavior ($t = 3.55$, $df = 4$, $p < 0.05$). All other statistical comparisons were not significant (Fig. 2).

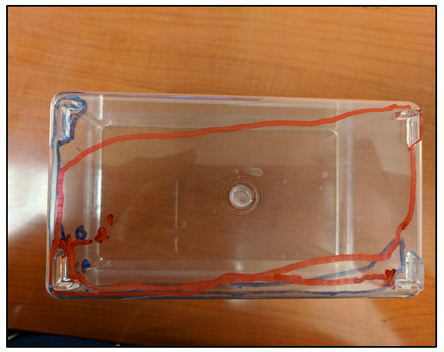


Fig. 1
Snail movement transcribed from video. Movement prior to scent introduction (blue line) and movement after scent introduction (red line).

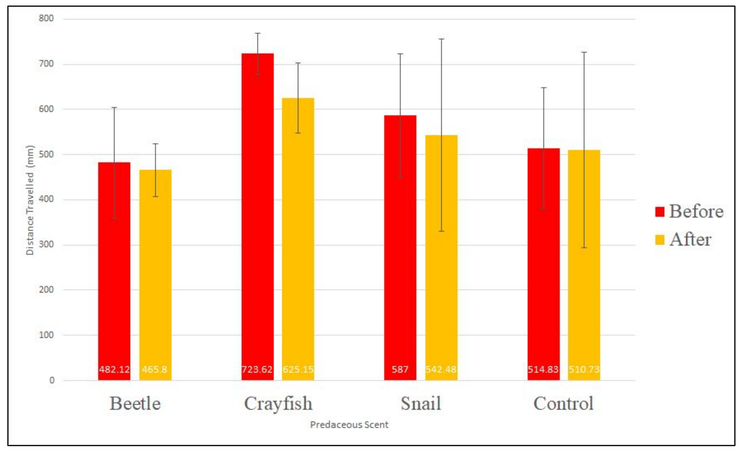


Fig. 2
Mean and standard deviation of snail movements before (red) and after (yellow) of snails exposed to different scents

In further support of predator avoidance behavior of *Physella acuta*, 60% (3 of 5) snails exited the water during experimentation with crayfish scent.

In none of the other trials (giant water bug, control, and snail) did focal snails exit the water.

Discussion

Statistical analysis reveals the presence of crayfish scent caused a significant change in the behavior of *Physella acuta,* indicating that *P. acuta* perceive crayfish as a predator (Fig. 2).

In some cases, *Physella acuta* would risk desiccation by leaving the water so as to not encounter what it believed to be a predatory crayfish.

Although the giant water bug used in this study is a known predator of aquatic snails, *Physella acuta* did not perceive it as a threat (Fig. 2).

It is likely that *Physella acuta* may have had some experience with the crayfish and not the insects. Both *Physella acuta* and the crayfish we worked with, were purchased from the same supplier.

The giant water bug, on the other hand, was purchased from a different supplier and our snails may have had no experience with it as a predator.

It should be noted that as expected, there was no significant difference in movement and behavior in *Physella acuta* during control experimentation

We would like to highlight that the scent of a distressed conspecific did appear to impact *P. acuta* although not as adversely as crayfish scent.

Procambarus clarkii (crayfish) is a known predator of *Physella acuta* especially more so than *Lethocerus americanus* (giant water bug)

Tests in polluted water, where *Physella acuta* may be unable to use chemosensation (effectively and efficiently), are forthcoming.

Literature Cited

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Acknowledgments

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