Unseen Caffeine: One Small Snail’s Struggle with a Common Stimulant

An Honors Thesis (HONR 499)

by

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Muncie, Indiana
April 2015

Expected Date of Graduation
May 2015
Abstract

As our population continues to grow and our use of pharmaceuticals and personal care products (PPCPs) including caffeine increases, it is more necessary than ever to protect our waterways and the organisms that live there. This project accessed the role of caffeine and its metabolite, paraxanthine, on Physa acuta growth, movement, and reproduction. Snails were gathered from the Upper White River watershed in central Indiana and exposed to two four-week toxicity trials with five chemical treatments: control (spring water only), low paraxanthine (0.05 µg/L), high paraxanthine (0.2 µg/L), low caffeine (0.2 µg/L), and high caffeine (0.5 µg/L). Change in snail length and snail location in vials did not vary among treatments (p > 0.10). Movement of control snails was higher in snails exposed to paraxanthine and caffeine in Trial 1 (p < 0.001) but not Trial 2 (p = 0.91). Snail fecundity was lower in snails treated with paraxanthine and caffeine, as they produced fewer egg sacs (p = 0.007) and eggs (p = 0.014). A decrease in P. acuta fecundity has the potential to influence whole communities, as predators that feed on P. acuta will likely need to change their feeding preferences to different gastropods. The fecundity of other gastropods may be similarly effected by caffeine and paraxanthine, exacerbating the effect to the food chain.
Acknowledgments

My success over the past four years has been wholly dependent on the love and support of my family.

I owe special thanks to Dr. Melody Bernot, who has expressed nothing but faith in my abilities. This thesis and my other research could not be possible without her.

To Dr. Tim Carter, Dr. Susan McDowell, and Dr. Barb Stedman who have helped me find the life path that I am on today.

Thank you.