

# Fine-scale plant defense variability increases top-down control of an herbivore

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## Abstract

Herbivore populations are regulated by plant defenses and natural enemies. While plant defense can suppress herbivore populations, these defenses adversely affect natural enemies thereby releasing herbivores from top-down control. Over their lifespans, herbivores and their natural enemies may experience substantial variation in plant defense. Defense variability can suppress the growth of herbivores, but the impacts of defense variability on natural enemies and top-down control of herbivores are unknown. We independently manipulated the mean and variation of a plant toxin experienced by individual *Trichoplusia ni* caterpillars and its parasitoid *Copidosoma floridanum*. Increases in the mean toxin concentration, but not its variance, experienced by individual *T. ni* and *C. floridanum* decreased the fitness of *C. floridanum*, whereas both mean and variance impacted *T. ni* fitness. Thus, increased defense variability for individual herbivores suppressed herbivore fitness with no perceptible cost to top-down control. However, impacts of variability depend heavily on scale of variability.

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# SUPPLEMENTAL TABLES AND FIGURES

**Table S1:** Diet Recipe. Ingredient amounts are for each diet and are listed used in order of addition. All ingredients were mixed with a Waring industrial blender. Xanthotoxin was added for experimental diets but not colony rearing.

<b>Ingredient</b>	<b>Amount</b>	<b>Source</b>
Soy Flour	12.5 g	Bio-Serv
Wheatgerm	37.5 g	Bio-Serv
Casein	25 g	Bio-Serv
Torula Yeast	31.25 g	Bio-Serv
Alfalfa meal	25 g	Bio-Serv
Ascorbic Acid	3 g	Bio-Serv
Sorbic Acid	1.5 g	Bio-Serv
Methyl Paraben	2.5 g	Sigma-Aldrich
Tetracycline	62.5 mg	Sigma-Aldrich
Xanthotoxin	0, 0.5, 1, 1.5, or 2 g	Sigma-Aldrich
Pinto Beans + Water (cooked)	62.5 g + 250 mL	
7.4% Formalin	10 mL	Mollinckrodt (Formaldehyde)
Raw Linseed Oil	6.75 mL	Sonyside
Agar (heated with water)	11.25 g + 500 mL	MoorAgar
Vitamin Mix	5 g	Bio-Serv