Bottom-up trait-mediated indirect effects decrease pathogen transmission in a tritrophic system

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density at the beginning of the experiment. The above equation can be easily fit to field data to estimate both the mean transmission rate $\bar{\beta}$ and the associated coefficient of variation C. If instead, there is no heterogeneity in the system and all individuals are equally susceptible, the corresponding differential equation integrates to $S(T)/S(0) = \exp(-\beta V(0)T)$ and only the transmission rate β needs to be estimated.

To understand how up regulation of plant secondary metabolites affects disease transmission, a series of experiments were conducted that manipulated plant induction status and virus-killed cadaver density. Induction was initiated by spraying either a solution containing 1 mmol/L of jasmonic acid (JA) dissolved in ethanol or distilled water on a group of similar sized soybean plants from the inducible Stonewall isoline (Underwood et al. 2000, 2002) every other day for 1 week. The period was chosen to ensure the defenses were induced over the course of the entire field experiment given that levels of defenses in soybeans can decline after 72 h when exposed to herbivores (Underwood et al. 2000) and was comparable to other long-term studies on soybeans (Accamando and Cronin 2012). Another group of plants were sprayed with a control solution that did not contain JA. Using herbivores rather than JA to induce the plants would present an additional challenge as it is often difficult to control for the amount of leaf material consumed across replicates (Baldwin 1996, Cipollini et al. 2003). Soybean plants were germinated and grown in a walk-in chamber at 28°C until being translocated to the field (LSU's Burden Center, Baton Rouge, Louisiana, USA). Virus density was manipulated by placing a varying number of infected first instars (0, 10, 20, or 40) on the plant. An infected first instar will produce 1.1×10^5 baculovirus occlusion bodies (95% Credible Interval [CI], $[0.8 \times 10^5, 1.3 \times 10^5]$) when the instar succumbs to the virus. By placing first instars on the plant rather than spraying virus, the given cop6o

gypsy moth may have ensured that all individuals contacted the virus, thereby reducing or eliminating the inter-individual differences or heterogeneity that result in nonlinear transmission. The reduction in consumption that was observed in the fall armyworm (Shikano et al. 2017), which corresponds to the preference data (Fig. 2D), may have increased differences among individuals, thereby strengthening transmission nonlinearities. Thus, the indirect effect mediated by the plant's induction status depends upon the defense being induced and the herbivore's response.

With regard to how secondary metabolites change resource quality and, subsequently, affect epizootic severity, a direct measurement of secondary chemical metabolites was not conducted for this study. However, it is well known that induction of secondary metabolites in soybeans affects the production of foliar phenolics and their composition within the leaf tissue (Shikano et al. 2017). Induction of t.2(the)-.6(n)-339.5t3cts the

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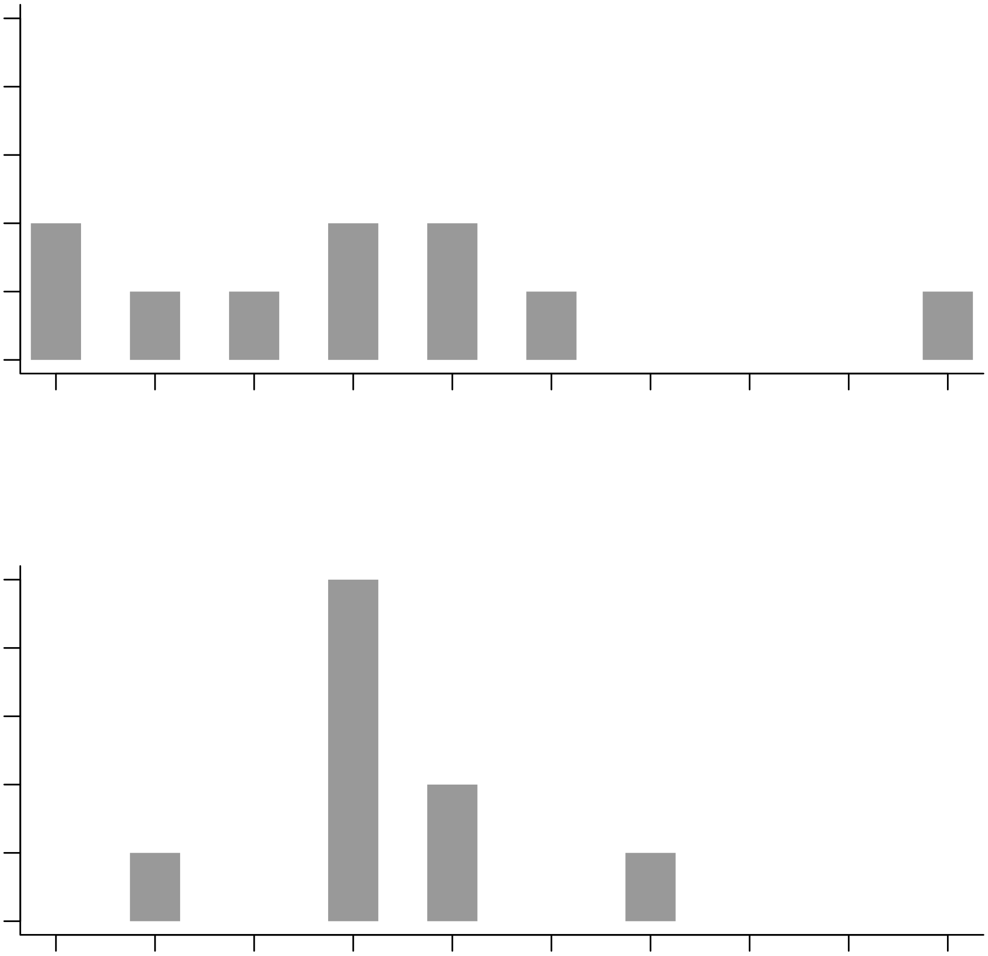
Appendix S1



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