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Ecological and Evolutionary Interactions between Fruitflies and Their

Parasitic Wasps

By

Neil F. Milan

Doctor of Philosophy

Graduate Division of Biological and Biomedical Science

Population Biology, Ecology, and Evolution

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Ecological and Evolutionary Interactions between Fruitflies and Their

Parasitic Wasps

By

Neil F. Milan

B.S., University of California, Davis, 2005

Advisor: Todd A. Schlenke, Ph.D.

An abstract of

A dissertation submitted to the Faculty of the James T. Laney School of Graduate Studies of Emory University

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Abstract

Ecological and Evolutionary Interactions between Fruitflies and Their

Parasitic Wasps

By Neil F. Milan

My dissertation project is focused on the evolution and ecology of the Drosophila-wasp parasitoid system, particularly the fruitfly *D. melanogaster* and wasps of the genus *Leptopilina*. The parasitoid wasps use an ovipositor (modified stinger) to inject eggs into fruitfly larvae or pupae. At that point, there is a competitive, with-in host interaction between the fruitfly’s immune response and the wasp egg invader. The immune response attempts to surround and kill the egg so that the fruitfly can complete its development; the wasp egg invader, in contrast, attempts to develop and emerge as a larva quickly enough to evade the immune response, in order to consume the host from the inside-out and develop into an adult wasp. The first research area is the effect of ethanol on the interaction between the fruitfly host and wasp parasitoid. While so much of the host-parasite interaction can be (and is) affected by the genotypes of the fruitfly and wasp, the surrounding environment in which the two interact may also crucially affect attack rates, immune system evasion and wasp development. I have been particularly interested in how the host-parasite dynamic changes when wasp parasitoids encounter fruitflies that feed on food plants that contain toxins to which the flies are resistant, but which may be toxic to the parasitoid. My work indicates that the presence of ethanol does limit wasp attack, hinders wasp infection success, and induces a “self-medication” behavior in parasitized fly larvae. The second research area is the horizontal gene transfer of transposable elements between fruitflies and their wasp parasitoids. Although the traditional view once held that genes are passed on only from parents to offspring, the last few decades have seen numerous reports of horizontal gene transfer between higher eukaryotes, including multicellular animals. Since hosts and parasites have very strong intimate associations, it can be hypothesized that there should be high rates of gene transfer between these organisms. Indeed, using the Drosophila-wasp parasitoid system I have found evidence for high rates of horizontal gene transfer, which is an exciting development for evolutionary biologists in particular because it may shed light on how novelty evolves within genomes and populations. Additionally, this host-parasite interaction may become a fertile system for deeper explorations of gene transfer in animals, which severely lack study models for probing and refining hypotheses.

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Ad maiorem Dei gloriam.

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