

Heritability and fitness consequences of cannibalism in *Harmonia axyridis*

James D. Wagner,^{1*} Melanie Dempsey Glover,¹ James B. Moseley² and
Allen J. Moore^{3‡}

¹Biology Program, Transylvania University, 300 N. Broadway, Lexington, KY 40508-1797,
²Department of Biology, Bowdoin College, Brunswick, ME 04011 and ³Department of Entomology,
University of Kentucky, Lexington, KY 40546-0091, USA

ABSTRACT

We examined environmental (food levels) and genetic (heritability and evolvability) influences on the expression of cannibalism in larvae of the ladybird beetle *Harmonia axyridis* Pallas (Coleoptera: Coccinellidae). In conjunction, we examined potential fitness consequences of cannibalism under different levels of food availability by measuring time of larval development and size at adult. Using a full-sib design, we split broods into food environments that differed by five-fold and measured rates of cannibalism by third instar larvae on first instar conspecifics. Surprisingly, there was significant genetic variation in the expression of cannibalism in response to increased prey levels. Some families exhibited a decrease in cannibalistic behaviour, some an increase, while some families did not alter their cannibalistic rate in response to different food levels. In the low food environment, there was a strong genetic basis for the expression of cannibalism with a heritability significantly different from zero. In the higher food environment, heritability was not significantly different from zero. However, evolvabilities for cannibalism were similarly high for both food level environments. Fitness consequences also depended on food levels. Larvae from the low food environments reduced their development time by approximately 1 day when they cannibalized an average of one first-instar conspecific larva. Although in the higher food environment rates of cannibalism did not decrease significantly, development times remained unaffected. Our results suggest significant genetic variation in the expression of cannibalism within a natural population of *H. axyridis* and selection favouring cannibalism under low food environments but not when prey levels are high.

Keywords: beetle foraging behaviour, Coccinellidae, evolvability, genetic variation, ladybird beetle, power analysis, quantitative genetics.

INTRODUCTION

Cannibalism has been recognized as a common form of size-selective predation in many organisms (Fox, 1975a; Polis, 1981; Elgar and Crespi, 1992). It has been suggested that natural selection may favour cannibalistic behaviour because the cannibal can enjoy two advantages over the non-cannibal: (1) the direct metabolic gain from eating a conspecific,

* Author to whom all correspondence should be addressed. e-mail: jwagner@transy.edu

‡ Address after July 1999: School of Biological Sciences, The University of Manchester, 3.614 Stopford Building, Oxford Road, Manchester M13 9PT, UK.



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