

Parasite Selection and the Fitness of Sexual Reproduction

Samantha A. Klosak, *Department of Biology, Indiana University Bloomington*

ABSTRACT

Sexual reproduction is a very costly process: the growth rate of asexual lineages exceeds that of sexual lineages. Nonetheless, sex is prevalent in nature. The Red Queen Hypothesis argues that, because sex and recombination generate genetically variable offspring that may escape infection by coevolving parasites, parasites select for sex in hosts (Lively & Dybdahl, 2000). Our research directly tests if the Red Queen can explain the maintenance of sex in a natural population. This experiment focuses on a natural population of the snail *Potamopyrgus antipodarum*, which is native to New Zealand. Individuals of this species are either diploid and sexually reproducing or triploid and asexually reproducing (Lively & Osnas, 2006). This snail is naturally infected by the trematode parasite, *Microphallus*, which is sterilizing and thus exerts strong selection on its host. The Red Queen Hypothesis predicts that parasites should periodically increase the fitness of sexual relative to asexual individuals. We accordingly established mesocosms containing both sexual and asexual snails from the same natural population. Half of these mesocosms were exposed to parasites and the other half were not. These snails were then allowed to reproduce over the course of a year. We used flow cytometry to determine the frequency of diploids in the parents and the offspring, and thereby the fitness of sexual individuals in the presence and absence of parasites. Interestingly, we find that sexual individuals are currently more susceptible to parasites than are asexual individuals. In tanks in which sexual parents are relatively more infected, the frequency of sexual individuals declined significantly more in the offspring generation, indicating a fitness consequence of parasitism for sexual reproduction. Our findings suggest that parasite selection can indeed operate on reproductive mode. Moreover, our results are consistent with theory (King, Delph, Jokela, & Lively, 2009) and a prior field study in our system indicating that the direction of parasite selection is variable, such that parasites periodically select against sexual reproduction (Vergara, Lively, King, & Jokela, 2013). This current experiment will continue for multiple years in order to track the variation in parasite selection on sex through time.

KEYWORDS: sexual reproduction, parasite selection, Red Queen Hypothesis

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All correspondence concerning this article should be addressed to Samantha A. Klosak at sklosak@indiana.edu

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