

Testing assumptions of the trade-off theory of the evolution of parasite virulence

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ABSTRACT

Background: Parasite replication is essential for transmission, but is thought to have inevitable virulent effects. The trade-off theory of parasite virulence asserts that parasites balance virulence (the increased death rate of infected hosts), which shortens the infectious period and thus reduces transmission opportunities, against transmissibility (the probability of transmission given a contact) to maximize overall transmission.

Questions: To what extent are virulence and transmissibility parasite traits? Are these traits correlated such that more virulent infections are more transmissible?

Methods: We infected tiger salamander (*Ambystoma tigrinum*) larvae with nine isolates of the *Ambystoma tigrinum* virus (ATV) and then exposed naive larvae to these infected larvae, measuring mortality rates in both to test the heritability of virulence. We then exposed five lineages of *A. tigrinum* larvae to five ATV isolates in a factorial design and measured mortality rates and virus shedding in each host–virus combination to determine the extent to which transmissibility and virulence are traits of the host and parasite, and whether they are related.

Results: Virulence is a heritable trait of virus isolates, but the variation among isolates is swamped by the much larger differences among host lineages. Transmissibility is clearly a viral trait. Within a given host lineage or across host–virus combinations there was little evidence that more virulent infections were also more transmissible. These results do not support the trade-off theory of virulence, but may reflect selection for alternative routes of ATV transmission.

Keywords: evolution of virulence, ranavirus, tiger salamander, trade-off theory, transmissibility.

INTRODUCTION

Parasite virulence, defined as the parasite-induced rate of host mortality, is often thought to be a product of parasite replication within a host. Greater replication rates in a host translate into greater virulence, but also into more transmission propagules. More virulent infections may therefore be more transmissible (i.e. more likely to be transmitted given an

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