The prevalence and persistence of sigma virus, 
a biparentally transmitted parasite of 
*Drosophila melanogaster*

Marta L. Wayne$^{1,2,3}$, Gabriela M. Blohm$^1$, Mollie E. Brooks$^1$, 
Kerry L. Regan$^{3,4}$, Brennin Y. Brown$^1$, Michael Barfield$^1$, 
Robert D. Holt$^{1,2}$ and Benjamin M. Bolker$^{1,5}$

$^1$Department of Biology, University of Florida, Gainesville, Florida, USA, 
$^2$Emerging Pathogens Institute, University of Florida, Gainesville, Florida, USA, 
$^3$UF Genetics Institute, University of Florida, Gainesville, Florida, USA, 
$^4$Department of Biological Sciences, University of Notre Dame, South Bend, Indiana, USA 
and $^5$Department of Mathematics, McMaster University, Hamilton, Ontario, Canada

**ABSTRACT**

**Question:** How do vertically transmitted parasites persist?  
**Organisms:** *Drosophila melanogaster* (host) and sigma virus (parasite).  
**Field site:** Peach stands in northern Georgia, USA, on a transect between Macon and Athens.  
**Empirical methods:** We estimated prevalence in the field. We also estimated male and female transmission in the laboratory, using field-collected animals as parents. We further quantified patrilineal (father to son) transmission in the laboratory, and estimated cost of infection (virulence) by quantifying decreased egg production of infected flies.  
**Mathematical methods:** Discrete-time, deterministic models for prevalence; analysis of stability of disease-free and endemic equilibria; numerical computation of equilibria based on empirical estimates.  
**Key assumptions:** Random mating, discrete generations, cost of infection to females only.  
**Predictions and conclusions:** The model allows persistence under parameter estimates obtained for this population. Uncertainty in parameters leads to wide confidence intervals on the predicted prevalence, which may be systematically underestimated due to Jensen’s inequality. Male transmission is required for persistence, and multiple generations of strictly patrilineal transmission are possible in the laboratory, albeit with decreasing transmission efficiency.  

*Keywords:* *Drosophila melanogaster*, evolution of virulence, host–pathogen co-evolution, persistence, prevalence, vertical transmission.
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