
Highly variable *Wolbachia* dynamics in fruit fly populations

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Résumé

Wolbachia are maternally transmitted endosymbionts that manipulate the reproduction of their hosts to favor infected females and consequently invade host populations. A pervasive mechanism is cytoplasmic incompatibility (CI), which results in reproductive failures between infected males and uninfected females. Theoretical models predict that (i) *Wolbachia* invasion depends on its transmission from mother to offspring, the intensity of CI and the fitness costs associated with *Wolbachia* and (ii) *Wolbachia* invasion should yield a transient decline in host population size. Recent experimental data on the fruit fly *Drosophila suzukii* departs from these predictions. In order to understand this discrepancy, we propose a novel generic model based on host population dynamics. The model aims at studying how bidirectional partial CI, associated fitness costs, and density-dependence in the host population affect the spread of *Wolbachia* and the host population size. For this, we developed a deterministic model based on a system of ordinary differential equations for the dynamics of females and males infected with different *Wolbachia* strains. We hypothesized the dynamics to be influenced by density-dependent competition, life history traits induced by the different *Wolbachia* strains and the patterns of incompatibility. Model parameters were estimated via Bayesian inference on experimental data. Various scenarios were then simulated in order to test the effect of different sources of uncertainties: (i) the sampling variance of estimated parameters, (ii) the demographic stochasticity on initial conditions, and (iii) the structural variation in the form of competition. Our model based on host population dynamics with realistic parameters allowed to unveil how tiny uncertainties affect *Wolbachia* invasion patterns.

Mots-Clés: Population dynamics, *Wolbachia* invasion, Cytoplasmic incompatibility, *Drosophila suzukii*

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