Strugarek, Martin; **Vauchelet, Nicolas**; **Zubelli, Jorge P.**
Quantifying the survival uncertainty of Wolbachia-infected mosquitoes in a spatial model.
(English) Zbl 1406.92522
Math. Biosci. Eng. 15, No. 4, 961-991 (2018).

Summary: Artificial releases of Wolbachia-infected Aedes mosquitoes have been under study in the past years for fighting vector-borne diseases such as dengue, chikungunya and zika. Several strains of this bacterium cause cytoplasmic incompatibility (CI) and can also affect their host's fecundity or lifespan, while highly reducing vector competence for the main arboviruses.

We consider and answer the following questions: 1) what should be the initial condition (i.e. size of the initial mosquito population) to have invasion with one mosquito release source? We note that it is hard to have an invasion in such case. 2) How many release points does one need to have sufficiently high probability of invasion? 3) What happens if one accounts for uncertainty in the release protocol (e.g. unequal spacing among release points)?

We build a framework based on existing reaction-diffusion models for the uncertainty quantification in this context, obtain both theoretical and numerical lower bounds for the probability of release success and give new quantitative results on the one dimensional case.

MSC:

92D25 Population dynamics (general)
92C60 Medical epidemiology
35K57 Reaction-diffusion equations

Keywords:

reaction-diffusion equation; Wolbachia; uncertainty quantification; population replacement; mosquito release protocol

Full Text: DOI

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