Effectiveness of periodic releases of Wolbachia-infected eggs or adults in reducing uninfected populations under seasonal fluctuations

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The mosquito *Aedes aegypti* is the main vector of dengue transmission arbovirus between humans. Traditional control methods rely on insecticides, which can harm ecosystems and promote resistance. An alternative strategy involves specific strains of *Wolbachia*, which reduce dengue virus replication in infected mosquitoes. Releasing *Wolbachia*-infected mosquitoes into the environment has been proposed to suppress wild-type mosquito populations and limit dengue transmission. Seasonal variations influence the timing of *Wolbachia*-infected mosquitoes, both eggs and adults, because mosquito dynamics are strongly influenced by temperature and humidity. We developed an age-structured partial differential model incorporating the life cycle of mosquitoes, key characteristics of infection by *Wolbachia*, and the release of eggs and/or adults of mosquitoes infected by *Wolbachia*. Using the method of characteristics, we reduce the model to a non-autonomous Nicholson-type delay differential system. To address seasonal fluctuations, temperature was defined as a cosine function with a period of 365 days. Because the model parameters depend on temperature, they also exhibit periodic behavior. We assume that the release of *Wolbachia*-infected mosquitoes occurs periodically in synchronization with seasonal variations. Using the Mawhin continuation method and some estimates that depend on the model parameters, we prove the existence and attractiveness of periodic solutions.Numerical simulations complement this theoretical study by investigating the best time to release *Wolbachia*-infected mosquitoes, depending on the seasonal abundance

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of wild-type mosquitoes, to achieve high levels of infection persistence. In addition, we compare the effectiveness of releasing infected eggs, adults or both.

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