Título: The Potential of Mathematical Modeling to Advance the Sterile Insect Technique for *Aedes aegypti* Control and Dengue Prevention

Abstract: *Aedes aegypti* mosquitoes are primary vectors of arboviruses such as dengue, Zika, and chikungunya in the Americas, representing major global health concerns. In Europe, *Aedes albopictus*, a closely related species, poses an increasing public health risk due to its rapid spread across the continent. The Sterile Insect Technique (SIT) offers a promising, environmentally friendly method for suppressing *Aedes aegypti* populations. However, effective implementation and evaluation of SIT require a thorough understanding of complex biological and ecological processes, along with strategic planning. Notable progress has been made in assessing SIT for *Aedes aegypti* control, particularly through initiatives in Cuba and other regions. We briefly present results from the Cuban SIT evaluation, along with perspectives on future implementation plans. In the context of these real-world applications, mathematical modeling provides a powerful framework for analyzing mosquito population dynamics under SIT pressure and estimating its potential impact on disease transmission. Here we present the potential of mathematical modeling to support SIT-based mosquito control. We explore how these models can be used to address key operational questions, such as determining optimal release strategies for sterile males (e.g., quantity, frequency, and spatial distribution), evaluating the influence of environmental variables (e.g., temperature, humidity, rainfall) on SIT performance, and assessing biological factors (e.g., sterile male competitiveness, dispersal, survival) that influence intervention outcomes. Additionally, we discuss which epidemiological components could be integrated into these models to help predict SIT's potential to reduce dengue transmission.