Computational Modeling of the Epidemiological Spread of Diseases Caused by Aedes aegypti

Ozava Fernandes, Amanda (School: Lausanne Collegiate School)

Linhares Menezes, Marcella (School: Superior Rafaelina E. Lebron Flores)

de Oliveira Rodrigues, Lívia

The high incidences of Dengue, Chikungunya, Zika and Yellow Fever epidemics have become a worrying factor for public health authorities. Aedes aegypti is the main transmission agent for those diseases and, its eradication is a complex task. The introduction of Genetically Modified Mosquitoes (GMM) into the environment is one of the actions under course to combat the spread of diseases, as their descendants cannot reach the adult phase. However, some information as "where" or "how many mosquitoes" are necessary for the decrease of wild population of these individuals are not well defined yet. This work uses computational modeling to map the population dynamics of the Aedes aegypti and, consequently, the diseases caused by that species. A mathematical model has been developed to simulate the behavior of a mosquito population and its interactions with human beings. The model also defines a state machine for the various stages of life and infection of humans and wild mosquitoes, and also their interaction with GMM. Simulation results could reproduce the dynamics of the healthy and infected populations of mosquitoes as well as the interaction of those populations with human beings. Furthermore, it was possible to qualitatively reproduce the influence of the GMM within the environment, showing a decrease of wild mosquito population and the number of infected humans over time.