Modelling the Ecological Dynamics Between the Coconut Scale Insect (Aspidiotus rigidus) Infestation on Coconut Trees (Cocos nucifera) With Comperiella calauanica as the Biological Control

Lauz, Jahna Bhec (School: Baybay City Senior High School)
Lambert, Allen Laurence (School: Baybay City Senior High School)
Dongon , Lady Nikki Beatrice (School: Baybay City Senior High School)

The outbreak of the coconut scale insect first occurred around May to August 2014, becoming a threat to the Philippines' coconut industry. The pest recurred around October 2017 and May 2025. In this study, the researchers modeled an ecological system that interprets the relationship between coconut trees and Aspidiotus rigidus with Comperiella calauanica as the biological control using a system of ordinary differential equations, based on Lotka-Volterra systems. The system was then optimized to determine the optimal parameters in managing the outbreak, and assess the accuracy to real-world data. The equilibrium points were determined, with a stability analysis done to examine the system's behavior, then a sensitivity analysis to perform parameter estimation. Out of four equilibrium points, two were stable, this implies that our system has two outcomes: a pest-free system and an endemic system. While an endemic state is possible, a pest-free state is achievable through targeted intervention. The simulations showed that utilizing C. calauanica as a biological control method effectively reduces the population of A. rigidus and the number of infested trees, particularly when its population is increased. Moreover, the system is accurate to real-world data, rendering it a reliable tool in predicting future outbreaks and implement adequate countermeasures, benefiting the PCA.

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