Eco Control of Agro Pests using Imaging, Modelling & Natural Predators

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Abstract

Caterpillars in their various forms: size, shape, and colour cause significant harm to crops and humans. This paper offers a solution for the detection and control of caterpillars through the use of a sustainable pest control system that does not require the application of chemical pesticides, which damage human health and destroy the naturally beneficial insects within the environment. The proposed system is capable of controlling 80% of the population of caterpillars in less than 65 days by deploying a controlled number of larval parasitoid wasps (Cotesia Flavipes, Cameron) into the crop environment. This is made possible by using a continuous time model of the interaction between the caterpillar and the Cotesia Flavipes (Cameron) wasps using a set of simultaneous, non-linear, ordinary differential equations incorporating natural death rates based on the Weibull probability distribution function. A negative binomial distribution is used to model the efficiency and the probability that the wasp will find and parasitize a host larva. The caterpillar is presented in all its life-cycle stages of: egg, larva, pupa and adult and the Cotesia Flavipes (Cameron) wasp is present as an adult larval parasitoid. Biological control modelling is used to estimate the quantity of the Cotesia Flavipes (Cameron) wasps that should be introduced into the caterpillar infested environment to suppress its population density to an economically acceptable level within a prescribed number of days.

Keywords: caterpillar pest control, system modelling, sustainable biological control, cotesia flavipes (cameron) wasps

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Dedication

We dedicate this paper to memory of Dr Ming-Yaw Huang who completed his Doctorate with us in the United Kingdom in 1994 and subsequently worked in Taiwan as a highly innovative and adventurous Engineer.