Mathematical Modeling of Host - Pest Interactions in Stage-Structured Populations: A Case of False Codling Moth [*Thaumatotibia leucotreta*]

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Abstract

False codling moth (FCM) (*Thaumatotibia lucotreta*) is a significant pest due to its potential economic impact on many susceptible fruits in most temperate regions of the world. Efforts to control the codling moth in the past mostly relied on the use of broad spectrum insecticide sprays, which has resulted in the development of insecticide resistance, and the disruption of the control of secondary pests. Understanding the dynamic of this pest is of great in importance in order to effectively employ the most effective control strategies. In this study, a mathematical model of host-false codling moth interactions is developed and qualitatively analysed using stability theory of system of differential equations. The basic offspring number with respect to FCM free equilibrium is obtain using next generation matrix. The condition for local and global asymptotic stability of FCM free and coexistence equilibria are established. The model is analysed numerically and graphically represented to justify the analytical results.

Keywords:

Mathematical modeling, False codling moth, stability Analysis, Host-pest interactions, Plant pest model.

1. Introduction

False codling moth (FCM), *(Thaumatotibia leucotreta)* is considered the most significant indigenous pest due to its potential economic impact on many horticultural and agricultural crops (Gillaga et al., 2011). larval attack over 70 host plants, many of which are horticultural crops with fruit, pods, and berries, such as beans, grapes, citrus, capsicum, avocado, guava, pomegranate, and ornamental plants. They also feed on macadamia nuts, cotton, tea, and a variety of other wild plants. Female moths are attracted to lay their eggs on the flower heads as well as other parts of the plant, making this pest particularly problematic on roses grown for cut flowers (Venette *et al.*, 2003).

Consequently, FCM is a major threat to food security, supply of raw material for manufacturing, foreign exchange

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