



Analysis and Numerical Simulations of Fractional Order Model of Insect-Pest Dynamics

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Received: January 1, 2025; Revised: February 1, 2026

Abstract: In this paper, we study a fractional-order version of the dynamics of insect-pests. We establish the existence and uniqueness of non-negative solutions and using the Laplace transform technique, we prove the boundedness of the solutions of the fractional model. Using Lyapunov's indirect method and the extension of LaSalle's invariance principle, we study the local and global stability of the equilibrium points of the fractional model. Moreover, we illustrate our theoretical results with numerical simulations of fractional model using the Adams-Bashforth-Moulton scheme.

Keywords: *Caputo fractional derivative; Riemann-Liouville fractional integral; insect-pest; numerical simulation.*

Mathematics Subject Classification (2020): 26A33, 34A08, 34A34, 37M05, 93-10.

1 Introduction

Insect-pests pose a threat worldwide, mainly in Africa, the economic and social burden of the damage caused by insect-pests such as fruit flies is increasing at both the producer and industry levels. Crop losses in these countries total billions of dollars and have a harmful impact on their economic situation and nutritional level [11]. In view of this threat, integrated pest management has been proposed to producers to combat this problem for the crops.

The massive use of pesticides as a means of controlling these insects leads to environmental pollution and economical waste. In addition, pesticides are generally harmful products and must be handled with care. Unfortunately, the precautions to be taken when handling these chemicals are unknown or ignored by producers. In this regard, the

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