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Mathematical Modeling and Analysis of a Caputo-Type Fractional-Order Model for Sugarcane Smut Transmission

Communication Info

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Abstract

In this work, we propose a fractional-order mathematical model in the Caputo sense to describe the transmission dynamics of sugarcane smut. The model incorporates several control strategies, including the use of resistant varieties, the treatment of shoots with approved fungicides, and the removal of infected plants. We then investigate the existence and uniqueness of the model solutions, and analyze certain qualitative properties of these solutions. The basic reproduction number is determined, along with the equilibrium points of the model. We subsequently analyze the local and global stability of the disease-free and endemic equilibrium point. A sensitivity analysis highlights the parameters and control strategies that have the most significant impact on disease propagation. Finally, numerical simulations are performed to illustrate the theoretical results obtained.

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