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BIOLOGICAL CONTROL OF DIAMONDBACK MOTH: A MATHEMATICAL APPROACH.

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Cabbage is one of the most important vegetables grown in the world. Pest activities result in the loss of a significant amount of its production. The most important of these is the diamondback moth. Several techniques have been developed to limit the damage caused by this pest, such as parasitoid-based biological control. In this work, we build a nonlinear model using ordinary differential equations by considering the biomass of cabbage in the field, the diamondback moth larvae population, and the larval parasitoid population. The growth of parasitoids on larvae is modeled using the Beddington-DeAngelis type functional response characterized by mutual interference of parasitoid β and pest resistance to predation α. In the first study, we assume that a quantity of parasitoids is introduced into the farm. We show that the best strategy to achieve permanent establishment and sustainable control is to use parasitoïds with a long life cycle. In the second study, we assume that the parasitoids are released continuously in the plantation. We show that solitary parasitoids have a better control effect than gregarious parasitoids because of their β low values. Thus, with parasitoids with low mutual interference, we compute a critical release value which represents the minimum rate of parasitoids to be introduced to obtain and maintain a healthy plantation. In addition, the system presents either a transcritical bifurcation or a backward bifurcation depending on the values of parameter α. Hence, this study provides both qualitative and quantitative foundations for the implementation of parasitoid-based biological control techniques.

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