

Mathematical Modeling of Honeybees: linking parasite infestations, diseases, foraging, and pesticides

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The honeybee, *Apis mellifera*, is not only crucial in maintaining biodiversity by pollinating 85% plant species but also is the most economically valuable pollinator of agricultural crops worldwide with value between 15 and 20 billion annually as commercial pollinators in the U.S. Unfortunately, the recent sharp declines in honeybee population have been considered a global crisis. In this talk, we will demonstrate how we develop different types of mathematical trackable models to explore how the crucial feedback mechanisms linking disease, parasitism, nutrition, pesticides and foraging behavior might be responsible for the colony growth dynamics and survival in a dynamical environment. Rigorous mathematics from those models that use nonlinear nonautonomous and/or delayed differential equations within metapopulation frameworks have been integrated with data to explore the contributing factors to the mysterious and dramatic loss of honeybees as well as provide a basis for new strategies for controlling *Varroa* and reducing colony losses for beekeepers, and benefit land managers.

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