

Biotic and abiotic stresses on honeybee health

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Problem Description

The decline in honeybee populations is a global concern, driven by a combination of biotic threats such as *Varroa destructor* mites and vectored viruses, and abiotic factors like pesticide exposure and environmental changes. These stressors often interact synergistically, exacerbating their negative effects on colony health. Despite extensive research, the complex interplay between these factors remains poorly understood, hindering effective conservation and management efforts.

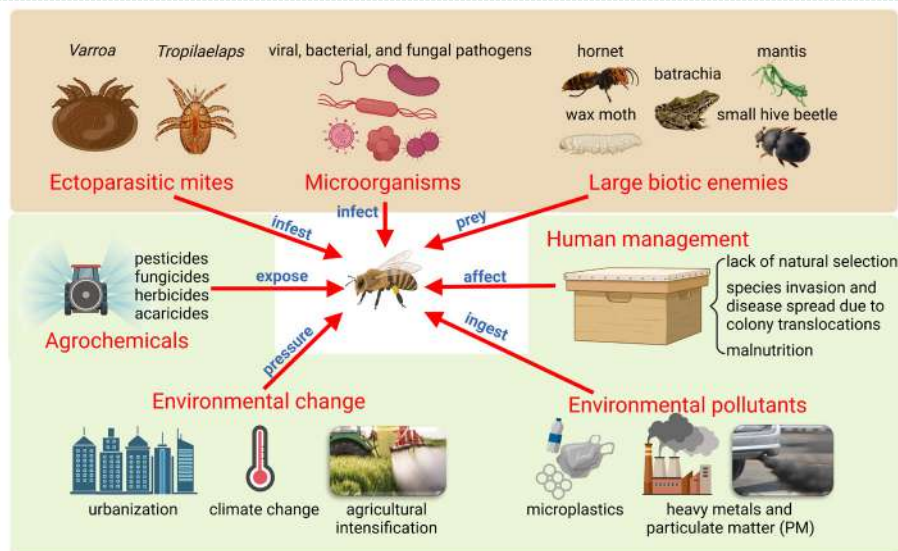
Background/Purpose

Honeybees are vital pollinators, playing a crucial role in sustaining ecosystems and agricultural productivity. However, they face a multitude of biotic and abiotic stressors that threaten their health and survival. These stressors include parasitic mites, pathogens, invasive species, agrochemicals, habitat destruction, and climate change. Understanding the interactions between these stressors is essential for developing strategies to mitigate their impact on honeybee colonies.

Methodology

This review synthesizes existing literature on the biotic and abiotic stressors affecting honeybee health. It examines the impacts of ectoparasitic mites, pathogenic microorganisms, invasive species, agrochemicals, and environmental changes on honeybee colonies. The review also explores the interactions between these stressors and their cumulative effects on colony survival and productivity.

Results and Conclusion



The review highlights that *V. destructor* and vectored viruses are among the most significant biotic threats, while agrochemicals and habitat loss are major abiotic stressors. Climate change further exacerbates these challenges by altering floral resources and increasing the prevalence of pathogens. The interaction between multiple stressors often leads to greater colony losses than any single stressor alone: pesticide exposure can weaken bees' immune systems, making them more susceptible to parasitic mites and viruses.

Practical Implications for Beekeepers

Beekeepers can adopt several strategies to mitigate these stressors, such as breeding mite-resistant bee strains, reducing pesticide use, and providing diverse foraging habitats. Regular monitoring and early intervention are crucial for managing colony health. Additionally, policymakers should consider the broader environmental impacts of agricultural practices and climate change to support sustainable beekeeping and pollinator conservation. By addressing both biotic and abiotic stressors, beekeepers can enhance colony resilience and ensure the continued provision of pollination services.

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