

Deformed wing virus (DWW) makes it hard to predict the impact of stress on honey bees

Background

Pesticides, as well as many other stressors, affect honey bee health and hive conditions. However, while the negative impact of some pesticides has been shown convincingly in the laboratory, studies in real-world conditions are contradictory.

Questions

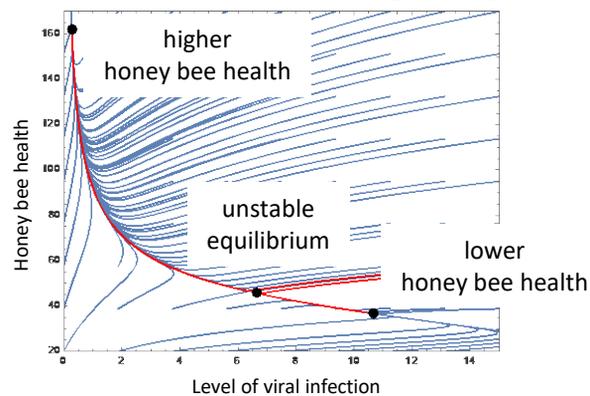
What is the cause of these contradictory results? Are harmful pesticides in the lab similarly harmful under realistic field conditions or not?

Methods

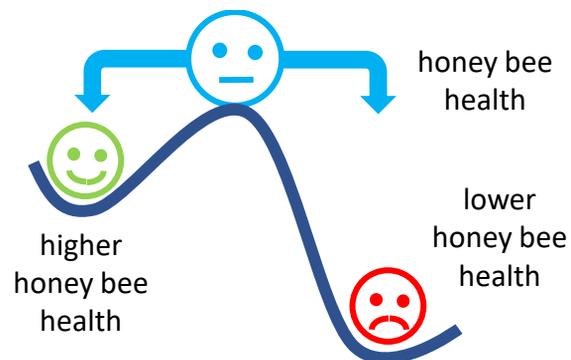
We developed a model of honey bee health as affected by parasites, pathogens, pesticides, suboptimal temperatures and food availability. We analyzed this system to study its possible equilibria (the possible outcome in terms of honey bee health when it does not change any longer).

Results

DWV can suppress honey bee immunity. This generates a situation where the honey bee has two possible stable health points, either low or high.



Thus bee health can be compared to a ball sitting on the top of a hill separating two adjacent valleys. The ball can either fall into one or the other valley, depending on any small initial perturbation.



Implications

If DWV is present, the addition of a second stressor, like a pesticide, can result in either satisfactory or low bee health. This will depend upon tiny differences in the initial state of the honey bee. This explains why real-world studies can produce conflicting results, and makes understanding of how stressors impact real-world honey bee health challenging!

Source

Breda, D., Frizzera, D., Giordano, G. et al. A deeper understanding of system interactions can explain contradictory field results on pesticide impact on honey bees. *Nat Commun* 13, 5720 (2022). <https://doi.org/10.1038/s41467-022-33405-7>