On continuous models and reliable numerics for the declines of honeybee colonies

Mataeli B. Lerata[1], Abdullahi A. Yusuf[2], and Jean M-S. Lubuma[1]
[1]Department of Mathematics and Applied Mathematics
[2]Department of Zoology and Entomology
University of Pretoria

This work is a follow-up to the authors' conference presentation [1].

In [1], three models were considered for the declines of the honeybee colonies. These are Khoury, Myerscough and Barron (KMB) model [2], the limit model of KMB model and a social parasitic model for the capensis calamity (cc). It was shown that there exists a critical value of the foragers' death rate, above which the "trivial" equilibrium is globally asymptotically stable (i.e there is colony collapse disorder (CCD)) for the KBM model and its limit whereas the CCD occurs unconditionally in the social parasitic model. Two nonstandard finite difference (NSFD) schemes that replicate the dynamics of the continuous models were constructed.

The current work focuses on comparing the two scenarios. We prove theoretically for both the continuous models and the NSFD schemes, and we illustrate through numerical simulation, that the decline of the honeybee colonies in the cc setting is faster than in the CCD situation.

References

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[2] DS. Khoury, MR. Myerscough, AB. Barron, A quantitative model of honeybee colony population dynamics, PlosOne 6(4) e18491, (2011).