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Modelling the impact of "resistance" on structured tick population dynamics

The resistance, behavioral and immunological response, has been reported in the biological literature but its impact on tick population dynamics has not been mathematically formulated and analyzed. Here we develop and simulate a delay differential equation model, with a particular focus on this "resistance" phenomena. We calculate the basic reproduction number using the spectral analysis of delay differential equations with positive feedback, and establish the existence and uniqueness of a positive equilibrium when the basic reproduction number exceeds unit. We also conduct numerical and sensitivity analysis about the dependence of this positive equilibrium on the "resistance" rate.