Dynamics of a structured slug population model in the absence of seasonal variation

Bees, M.A.[a] , Angulo, O.[b], López-Marcos, J.C.[c] and Schley, D.[d]

[a] Department of Mathematics, University of Glasgow, Glasgow, G12 8QW, United Kingdom
[b] Departamento de Matemática Aplicada, Escuela Universitaria Politécnica, Universidad de Valladolid, Spain
[c] Departamento de Matemática Aplicada, Facultad de Ciencias, Universidad de Valladolid, Spain
[d] Department of Mathematics and Statistics, University of Jaffna, Jaffna, Sri Lanka

Abstract

We develop a novel, nonlinear structured population model for the slug Deroceras reticulatum, a highly significant agricultural pest of great economic impact, in both organic and non-organic settings. In the absence of seasonal variations, we numerically explore the effect of life history traits that are dependent on an individual's size and measures of population biomass. We conduct a systematic exploration of parameter space and highlight the main mechanisms and implications of model design. A major conclusion of this work is that strong size dependent predation significantly adjusts the competitive balance, leading to non-monotonic steady state solutions and slowly decaying transients consisting of distinct generational cycles. Furthermore, we demonstrate how a simple ratio of adult to juvenile biomass can act as a useful diagnostic to distinguish between predated and non-predated environments, and may be useful in agricultural settings.

Author keywords

Numerical integration; Slugs; Structured population model