

Hares or Tortoises? How to Choose an Optimally Dispersing Biological Control Agent

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Abstract

For insect-plant interactions, dispersal can be an important process affecting the long-term dynamics of both populations. This is particularly relevant to the field of weed biological control which aims to correctly match a specialist herbivore with a target plant species such that a stable, low-density equilibrium will be achieved. There is, however, little information available to guide decisions with respect to the dispersal abilities of the insect agents chosen. To address this, an individual based simulation model was constructed to explore how the interaction between plant and insect dispersal affect both 1) plant population stability; and 2) average plant density. For plant population stability we found that simulating turning angles and step-lengths that resulted in intermediate rates of insect dispersal produced the most stable dynamics. We also found, somewhat counter-intuitively, that as plant dispersal increased, lower rates of insect dispersal were required to produce stable dynamics. Secondly, when considering average plant density, shorter step-lengths and straighter turning angles for insects tended to result in lower plant densities compared to larger steps and more tortuous paths. This pattern was consistent across the range of simulated plant dispersal strategies. These results suggest that in the absence of other stabilizing mechanisms, the dispersal rate of the agent relative to the dispersal of the target weed is an important factor to consider and that accurate dispersal estimates will enable more reliable predictions of overall efficacy.