
SyrFitSources: Investigating the effects of landscape composition and configuration on population dynamics of aphidophagous hoverflies with an agent-based model

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Abstract

The decline of insect biomass is an important aspect of biodiversity loss. To understand the drivers of this loss it is important to understand the factors affecting insect populations at multiple spatial and temporal scales. Spatially explicit models are a promising method to achieve this aim. Especially for hoverflies, a spatio-temporal life cycle model considering the different food resources for both imagines and larvae is missing.

In order to examine the effects of local habitat quality and landscape configuration on population dynamics, we developed an agent-based model (ABM) for the aphidophagous *Episyrphus balteatus*. To enable fast computation of syrphid behavior on a daily basis over many years in landscapes covering some square kilometers, we simplify the landscape to resource patches connected in a habitat network. To estimate the amount and phenology of floral resources per habitat, we used realistic lists of flowering plants for each habitat type based on the FloRes database. Further, the model simulates the development of aphid colonies dependent on air temperature, the feeding and progression of different stages of syrphid larvae, and the foraging behaviour and energy balance of imagines. The stage-specific larval mortality is calculated based on the number of aphids they feed daily and throughout the larval stage. For the imagines the mortality rate increases with the days they spend active and through the air temperature the active days were initiated.

Preliminary testing of the ABM shows that aphid availability is one of the most sensitive drivers of population development. However, sufficient floral resources matter for imagines, especially in spring. We are validating and fitting the models on a time series of *E. balteatus* abundance gathered with three Malaise traps set up in each of 13 landscapes located in rural sites of Lower Franconia and Lower Bavaria, Germany, in summer 2011.

Keywords: Insect decline, land use, *Episyrphus balteatus*, life cycle, larvae, imagines, aphids

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