

Climate mediated exogenous forcing and synchrony in populations of the oak aphid in the UK

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Abstract

Contemporary population dynamics theory suggests that animal fluctuations in nature are the result of the combined forces of intrinsic and exogenous factors. Weather is the iconic example of an exogenous force. The common approach for analyzing the relationship between population size and climatic variables is by simple correlation or using the climate as an additive covariable in statistical models. Here, we evaluated different functional forms in which climatic variables could influence population dynamics of the oak aphid *Tuberculatus annulatus* both in each locality and in relation to synchrony between localities. Results indicate that in at least four of eight aphid populations, climate influences population dynamics by modifying the carrying capacity of the system (lateral effect mediated by winter precipitation). Additionally, path analysis showed that synchrony in population dynamics is highly correlated with synchrony in winter precipitation regime, and the spatial scale of both processes is similar, which suggests that this is an example of the Moran effect. Our results show the key effects of precipitation on intra and inter population processes of this aphid. The methods used, mixing population dynamics modelling and test of synchrony, allowed us to connect the direct and indirect effects of exogenous variables into each population with patterns of synchrony inter populations.