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Landscape Complexity Impacts on Aphids and Their Natural Enemies

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Introduction

Ecosystems provide many services, such as pest regulation[1]. Pest control can utilise natural enemies to suppress pests from reaching critical economic thresholds[2]. Increasingly intensified agricultural landscapes and reduced landscape diversity has reduced natural pest regulation[3]. The provision of semi-natural habitats can enhance predator-prey interactions through increased spill-over effects and connectivity between populations[4].

Aim

To investigate the impact of contrasting agricultural landscapes on the changes in abundance of aphids, generalist predators and the rate of parasitism in wheat fields at multiple spatial scales.

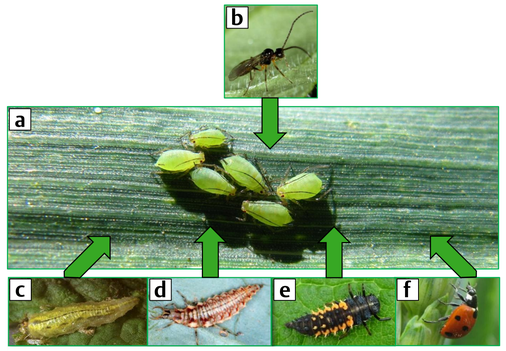
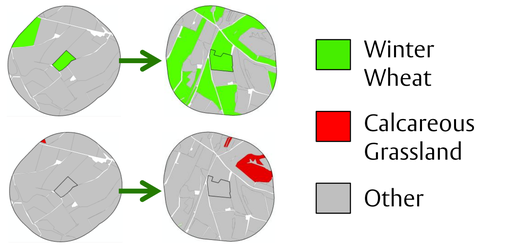


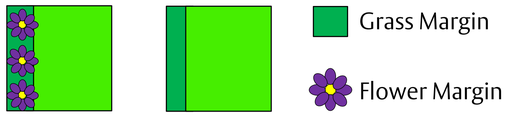
Figure 1: (a) Aphids and their natural enemies; (b) parasitoid wasps, (c) hoverfly larvae, (d) lacewing larvae, (e) ladybird larvae, and (f) ladybird adults.

Methods

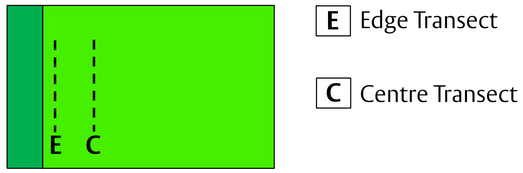
Two landscape gradient percentages were measured, winter wheat and calcareous grasslands, around each wheat field at 1km.



Wheat fields either had a resource rich flower strip or a typical grass margin.



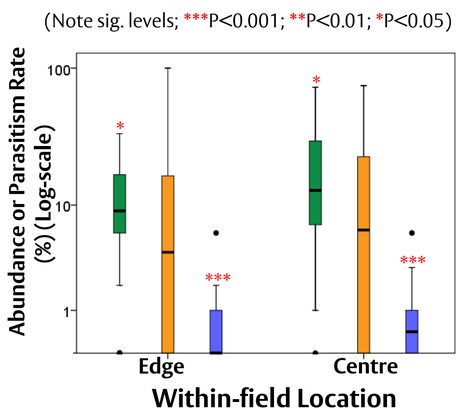
Within each field, two transects were surveyed, for the abundance of aphids, generalist predators and aphid-mummies. Parasitism rates were determined using aphid-mummies.

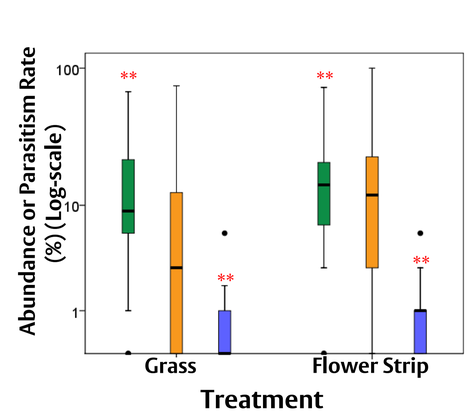


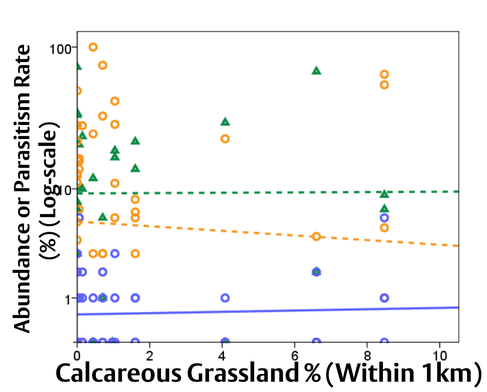
Wheat shoot density (m^2), meteorological variables and focal field area (m^2) were included as explanatory variables in GEE and LME models.

Results

(Note sig. levels; ***P<0.001; **P<0.01; *P<0.05)







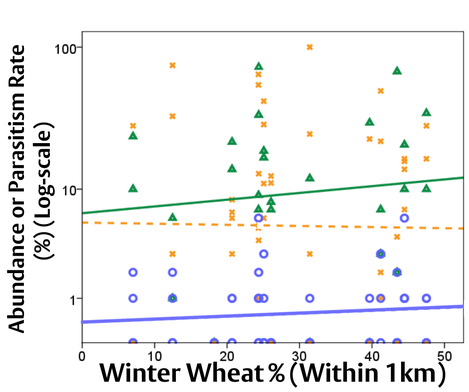


Figure 2: Abundance of aphids/125 shoots (■), predators/m^2 (■) and parasitism rate (%) (■) in transects (n=56; except parasitism where n=28). Sig. shown by asterisk or solid lines (dashed lines illustrate no sig.)

Conclusion

Aphids and generalist predators were sensitive to landscape composition at the field and landscape level; however parasitoids showed no response to landscape composition. Results reflect dispersal abilities, host and habitat specificities[5].

Field and landscape level management can be used to improve pest suppression. Landscapes with higher calcareous grassland percentages enhance generalist predators. However, in this study flower strips benefited not only the predators, but aphids as well.

Sources of Information

[1] UK NEA (2011) Technical Report; [2] Ostman *et al.* (2003) Ecol. Econ. **45**:149-158; [3] Chaplin-Kramer *et al.* (2011) Ecol. Lett. **14**:922-932; [4] Woltz *et al.* (2012) Agri. Ecosys. and Environ. **152**:40-49; [5] Rand *et al.* (2006) Ecol. Lett. **9**:603-614. Various images sources.

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