Smart grassland systems:

The relationship between sward diversity and invertebrate communities in experimental grasslands

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Smart grass
Biodiversity for production

Introduction

Terrestrial arthropods represent a significant component of functional biodiversity within agricultural ecosystems. They contribute to the overall sustainability of these systems through their involvement in a range of ecosystem processes, i.e. nutrient cycling and pest biocontrol. Ecological theory states that multi-species plant communities should support a greater diversity of invertebrates relative to a monoculture crop; this is due to the wider range of potential niches they provide (Cardinale *et al*., 2007). This study focused on populations of parasitic Hymenoptera and Coleoptera. It was hypothesised that these invertebrate groups would be more abundant in the multi-species swards compared to the monocultures due to the presence of more plant functional groups.

Materials & methods

The experiment, established in the summer of 2013, uses a constrained simplex-centroid design (Cornell, 2002) with nine plant species representing three functional groups (grasses, legumes and herbs). Grazing was simulated by cutting to a height of 4cm eight times during the growing season.

Invertebrates were sampled using a Vortis suction sampler (Burkard Manufacturing Ltd.) in June and August 2014, two weeks after the previous harvest, i.e. at the midpoint of growth. Samples consisted of 10 randomly positioned suction samples each of 10 sec. duration (covering a total area of 2 m^2 per plot).

Samples were preserved in 70% ethanol prior to sorting and identification. Parasitic Hymenoptera and Coleoptera individuals were counted from eight suction samples taken during August 2014. These eight samples represent a subset of the SmartGrass plots; they each receive an input of 90 kg N ha^{-1} yr^{-1}, and range from one to three functional groups, which are present in varying ratios (there is a minimum of 40% grass in all plots for agronomic reasons). Statistical analysis was performed using MINITAB. Multiple regression analysis was used to investigate if there was a relationship between the abundance of parasitic Hymenoptera and Coleoptera and the presence/abundance of plant functional groups.

Results/Discussion

Parasitic Hymenoptera and Coleoptera were most abundant in plots with a mixture of legume, herb and grass (Figure 1). These results indicate that multi-species swards support a greater abundance of parasitic Hymenoptera and Coleoptera. A comprehensive study has shown that the abundance of parasitic Hymenoptera can be used effectively to predict overall arthropod taxon richness in agro-ecosystems (Anderson *et al*., 2011). Multi-species swards have huge potential for transforming agricultural grassland ecosystems in Ireland from those supporting small, non-diverse populations of invertebrates to those supporting a more diverse community, which may lead to enhanced ecosystem functioning and improved provision of ecosystem services.

References

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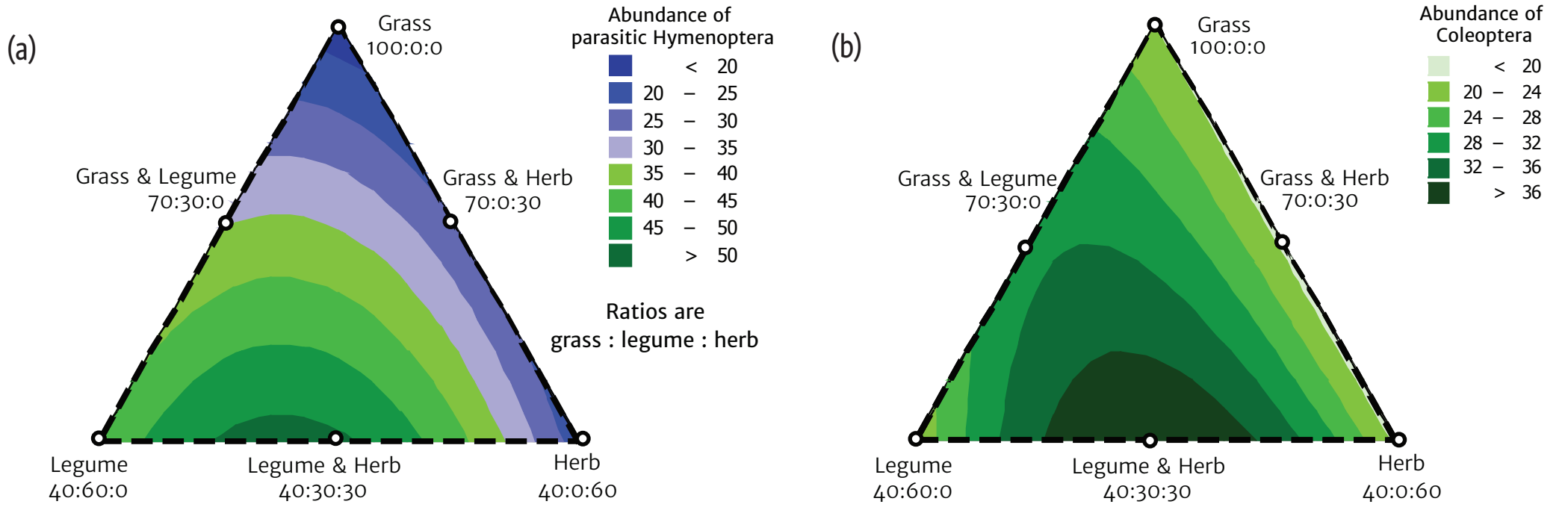

Figure 1. Contour plots from multiple regression analysis, interaction effects of legumes & herbs for: (a) parasitic Hymenoptera (p=0.08, r^2 = 94.4%) (b) Coleoptera (p=0.02, r^2 = 97.76%), n=8.

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