Intra-field floral resources to enhance biological control: do interactions with other flower-visiting insects affect parasitism rate?

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Abstract

Developing more sustainable cropping systems has become a major challenge in the current context of pesticide reduction. Supporting natural regulation processes, such as pest control by arthropods (called natural enemies), could help achieve this goal. It is known that increasing plant diversity should enhance abundance and diversity of natural enemies through an increased provision of resources (prey resources and plant resources such as nectar and pollen). Adding floral resources nearby crops should thus enhance pest control. Nevertheless, interactions between flower-visiting arthropods, and their effect on pest control, is very scarcely considered. In particular, floral resources also attract pollinators, such as honeybees that harvest in large quantities on many plant species and are often in strong numeric imbalance. Therefore, a competition for floral resources between floral-visitors can be hypothesized. In this study, we focus on the effect of intra-field floral resources on aphid control by parasitoid wasps along a gradient of pollinator abundance. The model used was cereal crops mixed with two flowering crops: faba bean (*Vicia faba*) and pea (*Pisum sativum*). We expect that (a) the presence of faba bean and pea in cereal crops (mixed cultures) will increase aphid parasitism rate compared to cereal mono-cultures, as they provide food (faba bean extra-floral nectar) and alternative aphid hosts; (b) a high abundance of bees could lead to a reduction of the aphid parasitism rate. On 18 fields (10 crop mixtures and 8 cereal mono-cultures), aphid parasitism rate was estimated every two weeks (by direct counting in the field and by barcoding), along with pollinator abundance (with colored pan-traps) and flower-visitors foraging behaviors. This study could provide knowledge on possible interactions between beneficial insects, that appears important to evaluate current plant diversification strategies used in agriculture, and optimize them to enhance both crop pollination and conservation biological control.

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