Diversity of model-based scenario approaches of biodiversity evolution in agricultural landscapes. A review
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The Effect of Contrastened Perennial Flower Strips on the Parasitism of Oilseed and Faba Bean Herbivores
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Abstract: The implementation or management of habitats to improve functional biodiversity is known to increase natural enemies of herbivores, but it does not necessarily lead to a significant reduction in crop herbivores. The performance of flower strips and natural enemies in terms of biological control depends on many factors and we need to understand why some mixtures of plant species perform better than others.

During a four-year field experiment, we compared the effect of eight contrasting floral mixtures comprising native and perennial plant species. We have varied the proportion, the species and functional diversity of plant species providing resources toward natural enemies. These mixtures were compared with control plots consisting of a strip sown with the crop species each year. Each flower mixture was sown on a 6×45m strip and replicated on three blocks. Vegetation relevés were carried out in the spring to determine the amount of plants providing easily accessible nectar to parasitoids, based on flower morphology. In the adjacent crop, at 5 and 20m from the strip, we evaluated parasitism levels of (1) larvae of Meligethes aeneus (caused by Tersilochus heterocerus) collected from rapeseed flowers, (2) Dasinea brassicace by dissection of pupae collected in the soil after the rapeseed harvest and (3) Bruchus rufimanus within faba bean seeds by examining exit holes of B. rufimanus and of their parasitoids. These parasitism rates were also compared to those found in control fields at least 250m away from our experimental field. No insecticide was used in any field.

Parasitism of M. aeneus larvae was generally very low. It was 8% on the control plots and varied between 8 and 19% at 5m from each flower strip. At this distance, the parasitism rate increased with the amount of flowering species in April providing easily accessible nectar, but this effect was less clear at a distance of 20m. For D. brassicace, 55% of pupae were parasitized without any effect of flower mixtures or distance to the strip in the field. In faba bean seeds, parasitism of B. rufimanus was 25% in the control field, 33% in the control plots and 47% in front of the flower strips, without any distance effect. The parasitism rate increased with the amount of flowering species providing easily accessible nectar in May. At the same time, the proportion of seeds damaged by B. rufimanus was lower at 5 than 20m from the flower strips (54 vs 70%). No effect was found on crop yield as the parasitism occurs after the damage has been caused to the crop.

For two of the three herbivores studied, we demonstrate (1) that the composition of plant communities near crops influences their parasitism rate and (2) that this biological control can be strengthened by the establishment of flower strips providing food resources in April and May, i.e. during the parasitoid activity period. The differential effects of flowering strips were related to the quantity of plants providing easily accessible nectar.

Keywords: Conservation biological control, Meligethes aeneus, Dasinea brassicace, Bruchus rufimanus