Wildflower strips to reduce lepidopteran pests in cabbage crops

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Abstract: Vegetable production systems are highly intensive and the periodic cultivations lead to unfavourable conditions for natural enemies. Using non-crops it is possible to create ecological infrastructure offering suitable food for natural enemies, and shelter from adverse conditions. On four organic farms in Western-Switzerland, we have tested in cabbage crops if wildflower strips are an appropriate tool to reduce lepidopteran pests. Analyses of wildflower strips on parasitism of caterpillars of *Pieris rapae* and *Mamestra brassicae* indicated a pest control potential. Grid trial using reared egg batches revealed no significant effect on parasitism of exposed *M. brassicae* and *Plutella xylostella* eggs in relation to the distance of the strip.

Key words: parasitoids, conservation biocontrol, vegetable, non-crop habitat, natural enemies

Introduction

Agroecosystems are unfavourable environments for natural enemies due to high levels of disturbance, habitat fragmentation and loss of suitable habitats (Gurr *et. al*., 2004). Especially vegetable production systems are highly intensive and the periodic cultivations lead to unsuitable conditions for natural enemies. Therefore a diversification through habitat manipulation is essential to create an appropriate ecological infrastructure offering suitable food for adult natural enemies, alternative prey or hosts, and shelter from adverse conditions. Non-crop habitats lead to a general improvement of suitable refuges which serve as overwintering sites and sheltering sites before and after crops have been harvested (Pfiffner & Luka, 2000). There are few field studies analysing flowering strips in vegetable crops (Lee & Heimpel, 2005; Winkler, 2005). The main question of this field study was to investigate if the use of the officially recommended wildflower strips is an appropriate tool to reduce key lepidopteran pests in organic cabbage crops.

Material and methods

The parasitism of lepidopteran pest was investigated in relation to presence or absence of adjacent sown, species rich wildflower strips at four sites in arable landscapes of Western-Switzerland. A seed mixture was used containing 24 wildflowers which is officially recommended within the Swiss agri-evironmental program to improve biodiversity on arable land (Pfiffner & Wyss, 2004). Naturally occurred caterpillars of *Pieris rapae, Plutella xylostella* and *Mamestra brassicae* have been sampled in unsprayed cabbage fields up to nine dates in 2001 and 2002. The strips were 3 m in width and 1- to 3-year old.

In a 2nd step on two farms, a grid trial was performed in order to analyse the spatial pattern of parasitism of *M. brassicae* and *P. xylostella* in relation to the distance of the one-year old wildflower strips. Batches of reared eggs were exposed during three days at four dates in 2004 and 2005. Egg batches were pinned to plants in a grid of 3 m to 3 m (up to 48

points per block) of the two fields on two farms. Each field consisted of two blocks, one with an adjacent wildflower strip and the other as a control plot without a wildflower strip (Fig. 1).

Results and discussion

Microplitis mediator, Cotesia rubecula and *Diadegma semiclausum* were found to be the most abundant parasitic wasps of caterpillars with an amount of 74%-94%. Egg parasitoids of diamond backmoth and cabbage moth were mostly *Telonomus sp.* and only in some cases *Trichogramma evanescens*.

The parasitism rate of *Mamestra brassicae* and *Pieris rapae* caterpillars was mostly higher in the cabbage fields adjacent to the wildflower strip than in the field without a strip. The parasitism rate of *P. rapae* decreased with increasing distance to the strip. In contrast, *Plutella xylostella* were found to be more parasitized in the treatments without strips.

Using exposed egg batches of *M. brassicae* and *P. xylostella* within a grid trial revealed no significant effect in the distances of 3 m to 24 m from the wildflower strip. Eggs of *M. brassicae* were moderately (Fig. 1) and these of *P. xylostella* (1-2%) were rarely parasitized.

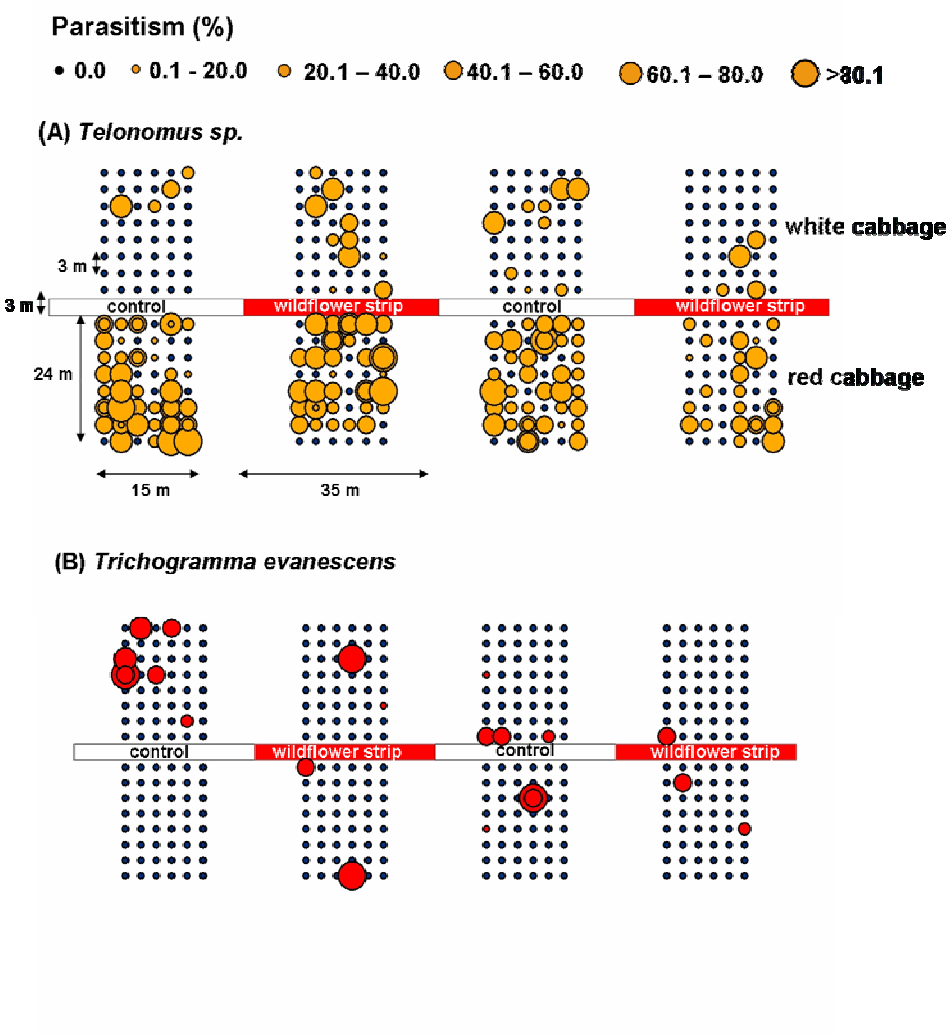

Figure 1. Exposed egg batches of *M. brassicae* parasitized by *Telonomus* sp. (A) and *Trichogramma evenescens* (B) in a grid of 3 m x 3 m. Pooled data of two dates 2004.

Our on-farm trials showed that wildflower strips may increase the parasitism of caterpillars of *M. brassicae and P. rapae*, but no reducing effects on *P. xylostella* - as egg as well as larval stage - were found. Furthermore, grid trial using reared egg batches revealed no significant effect on parasitism of exposed *M. brassicae* and *P. xylostella* eggs in distances of 3 m up to 24 m from the wildflower strip. Parasitism of *M. brassicae* eggs may also be greatly affected by landscape factors as Bianchi *et al*. (2005) found in Brussel sprout.

To increase pest-control a specifically tailored biodiversity to the needs of key natural enemies is necessary, and furthermore a general improvement of biodiversity on the whole farm may substantially enhance other natural enemies. It is a key issue to use selective plants in field margins with a minimal benefit for the pests. After a careful assessing of the suitability of flowering herbs, it is useful to develop crop-specific tailored wildflower strips (e.g. Wäckers, 2004; Winkler, 2005).

However, more knowledge on temporal-spatial dispersal pattern of natural enemies between non-crop and crop habitat on local and regional scale is needed to assess the efficiency for pest-control function.

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