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Diversification of crop and non-crop vegetation in agricultural landscapes: a benefit for pollinator communities

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Introduction

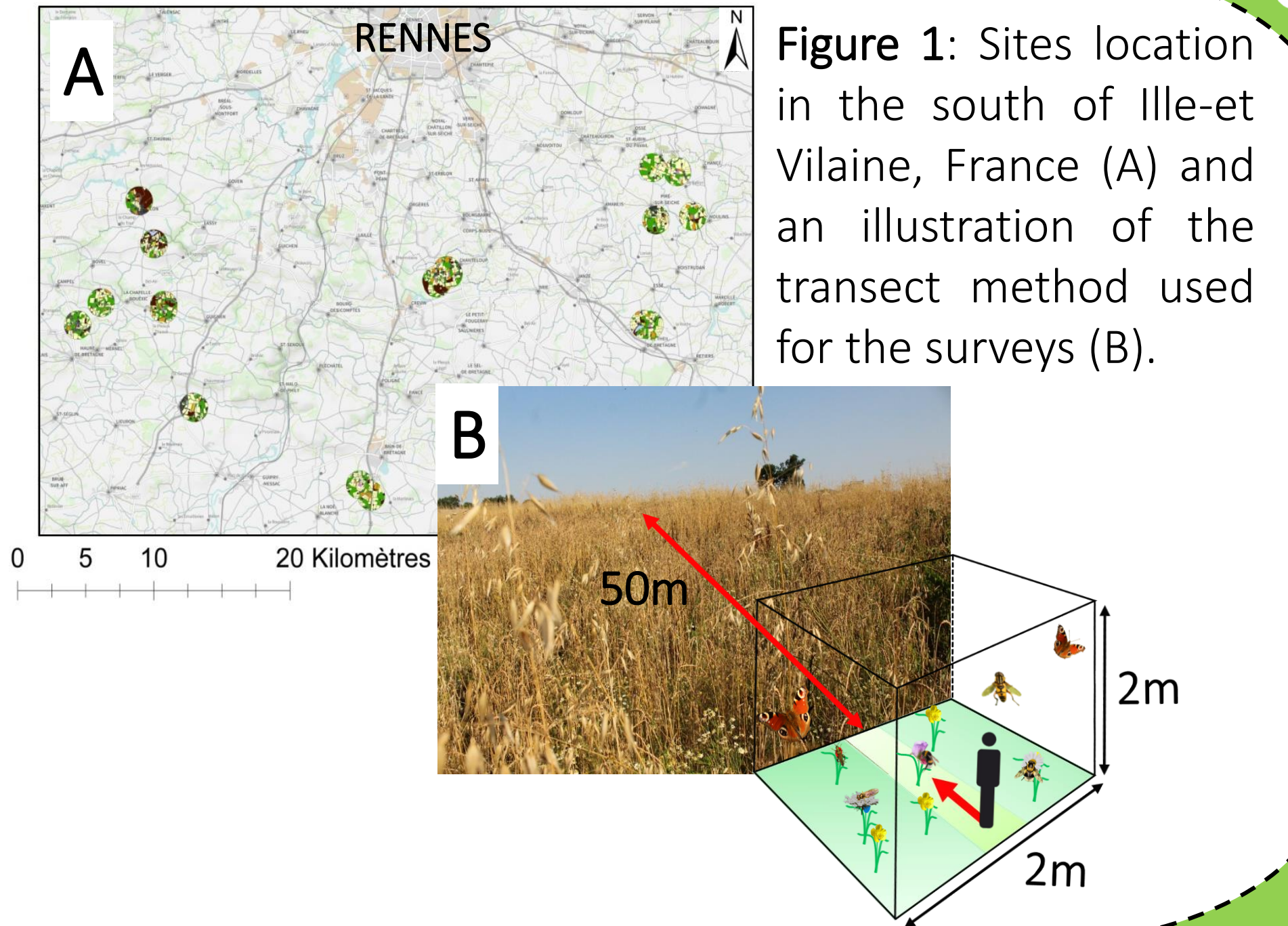
Diversification of crop or non crop vegetation is considered a promising management strategy to promote pollinators¹.

Previous works have only investigated the effects of non-crop vegetation at field margins on pollinators.

Here, we aim to disentangle the effects of weed and cultivated vegetation diversity on the diversity and abundance of pollinators in crop fields and their field margins.

Study area and Methods

Pollinator and flowering plant surveys were carried out, from May to July 2018, on 50m long transects in 10 pairs of monoculture and mixed-crop fields (faba bean or pea with cereals) and their margins along a gradient of landscape heterogeneity, in the Zone Atelier Armorique (France).



Results

Crop fields

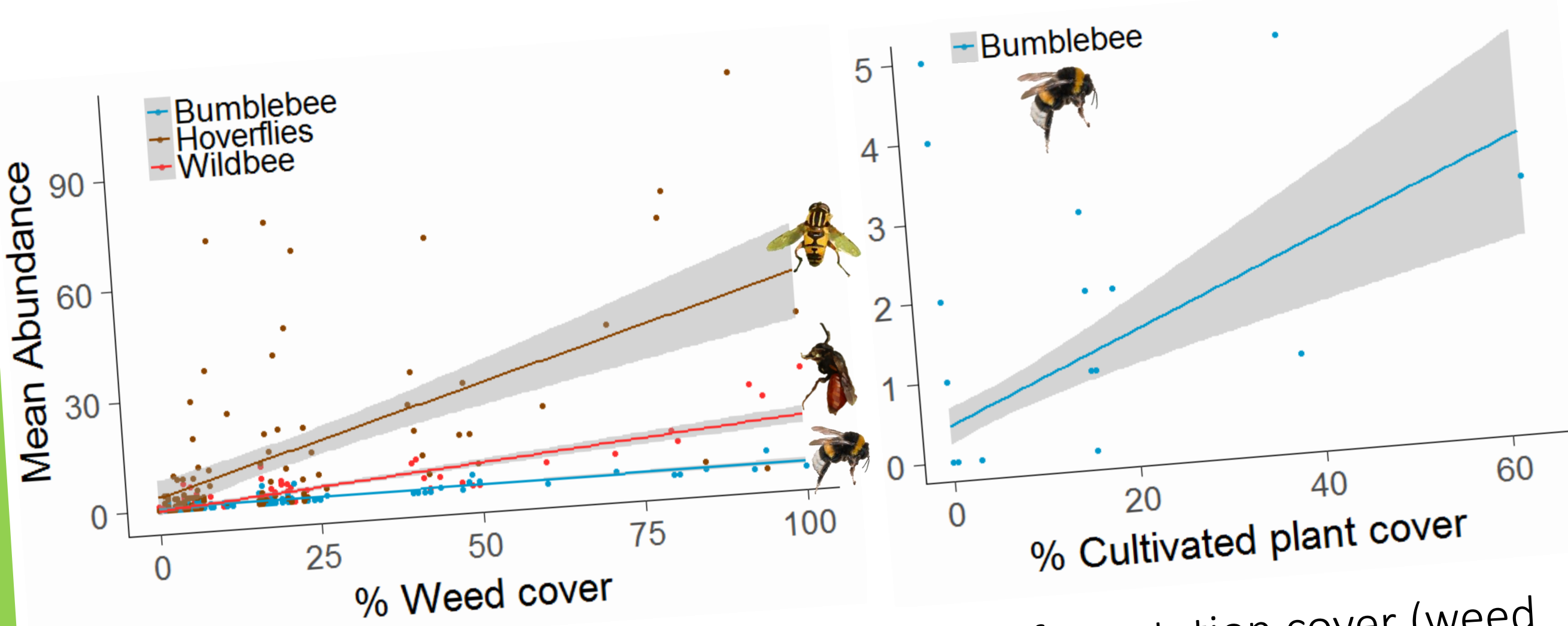
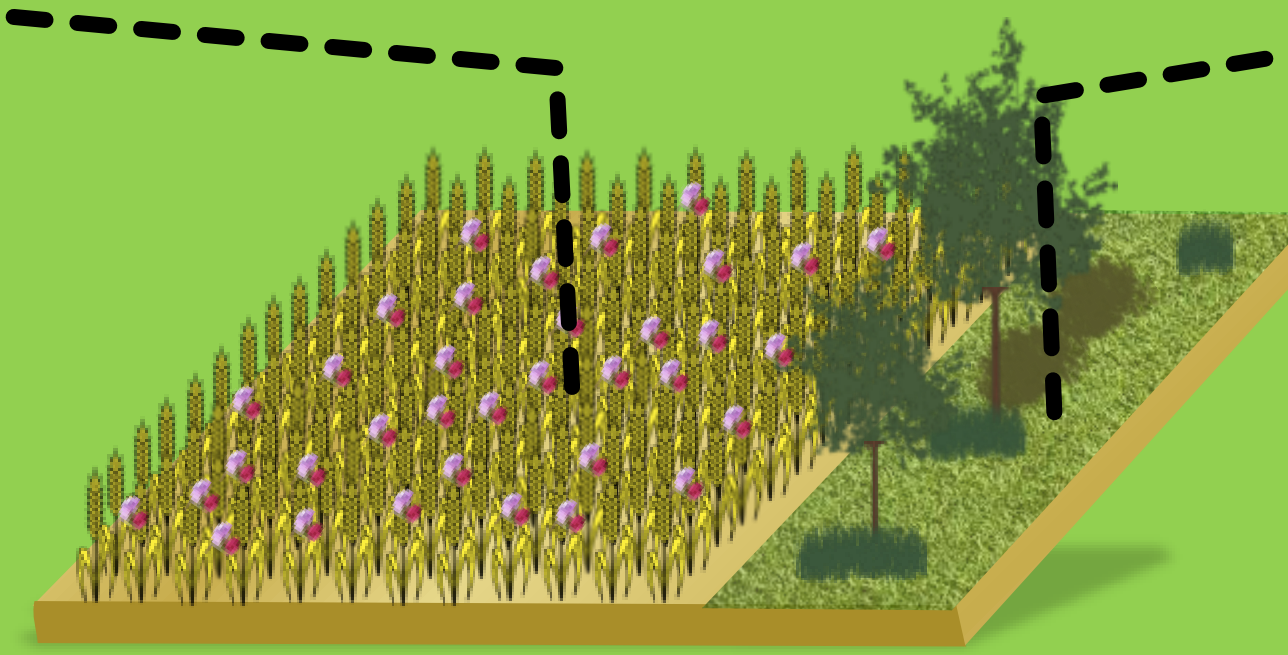


Figure 2a: Significant effects (GLMM, $p < 0.05$) of vegetation cover (weed or cultivated plants) on pollinators in fields (N = 98).

In fields, weed cover has a positive effect on the abundance of all pollinator groups whereas crop plant cover has only a positive effect on bumblebee abundance.

We recorded 114 flowering plant species and 3950 pollinators belonging to hoverflies (56%), wild bees (15%), bumblebees (4%) and other pollinators (23%).



Field margins

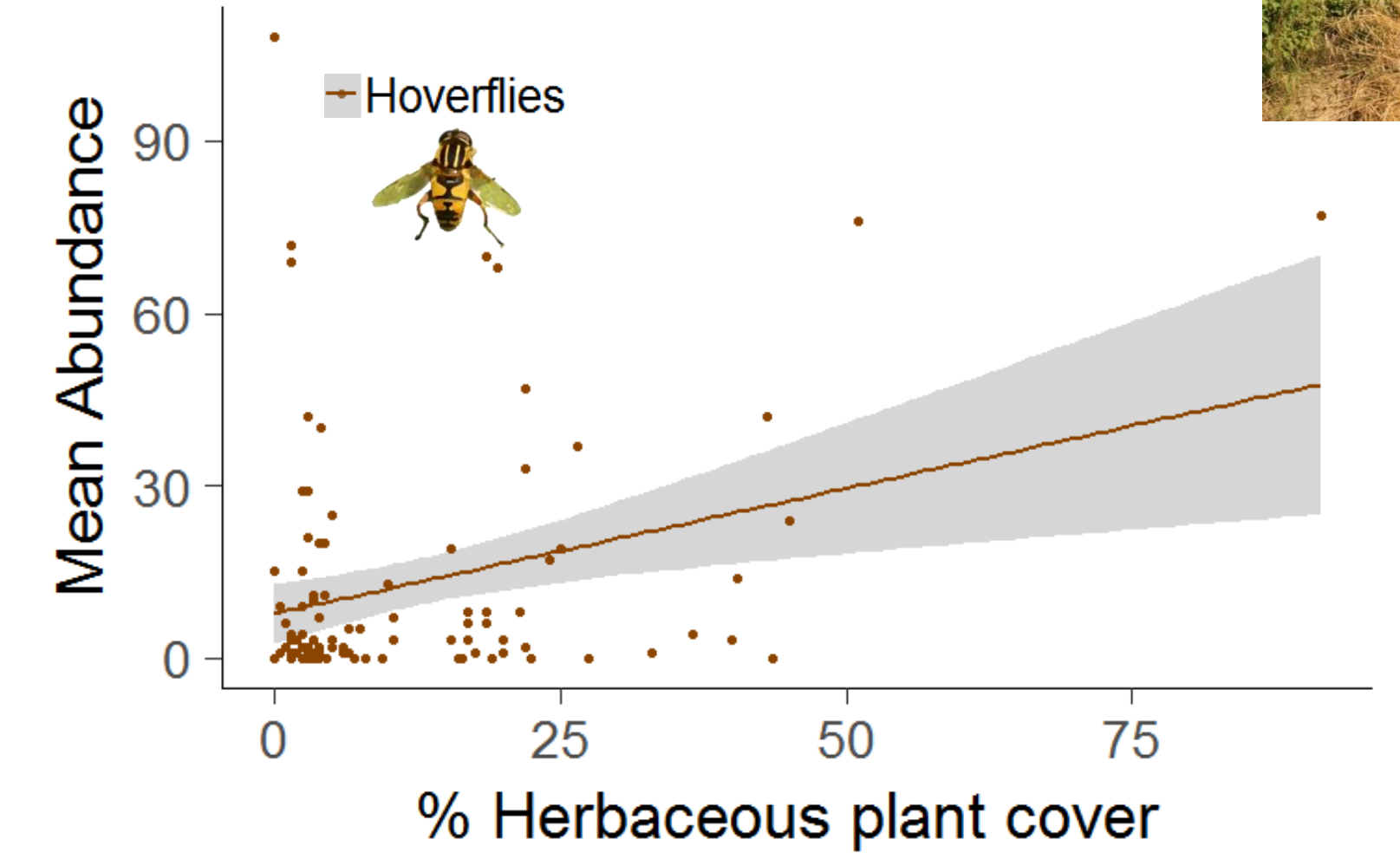


Figure 2b: Significant effect (GLMM, $p < 0.05$) of herbaceous vegetation cover on hoverflies in field margins (N = 98).

In adjacent field margins, both herbaceous and woody plant cover have a positive effect on some groups of pollinators (e.g. hoverflies).

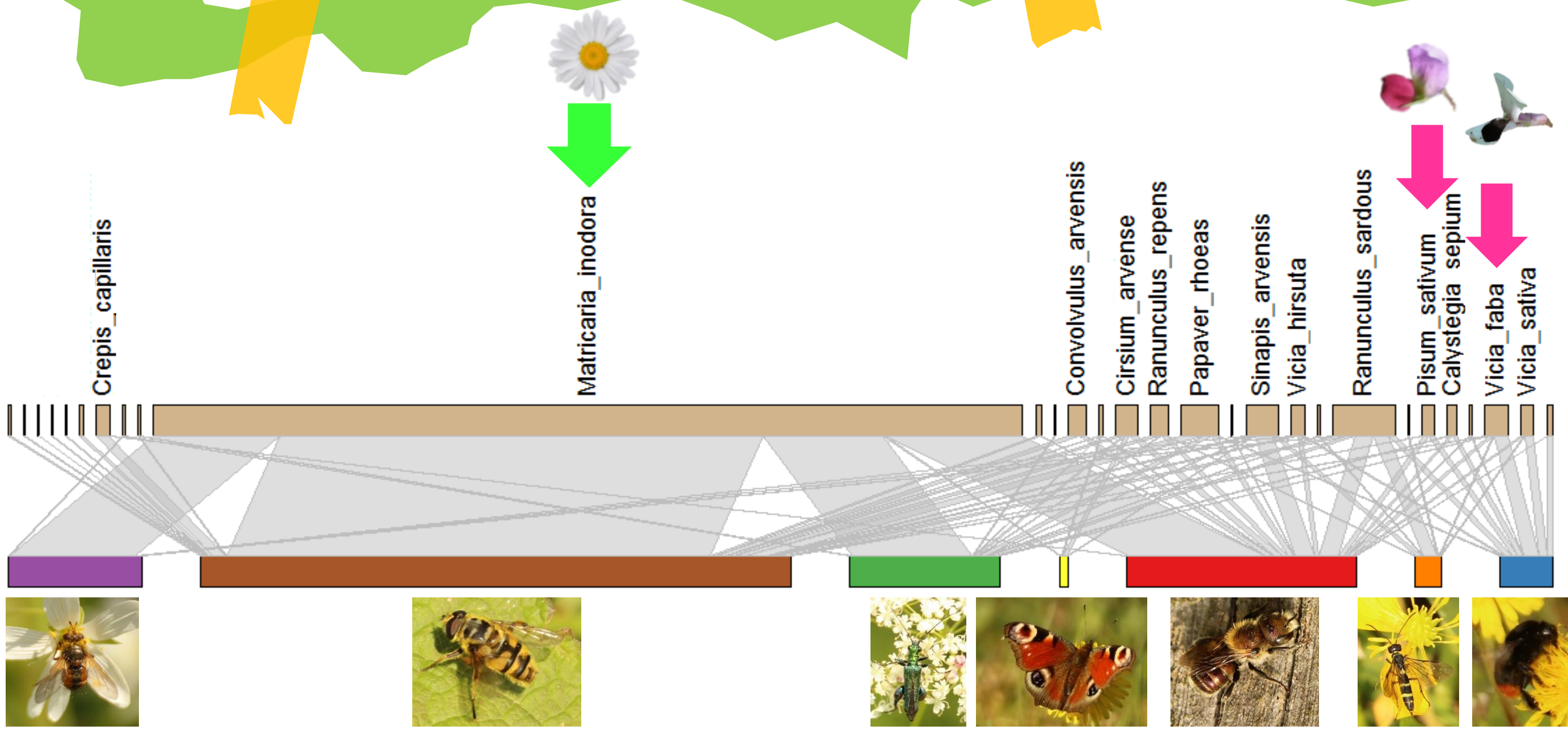


Figure 3a: Plant-pollinator networks in crop fields (N = 1008 interactions). Only the main plant species are named for visibility. Arrows show an important weed species (green) and cultivated species (pink).

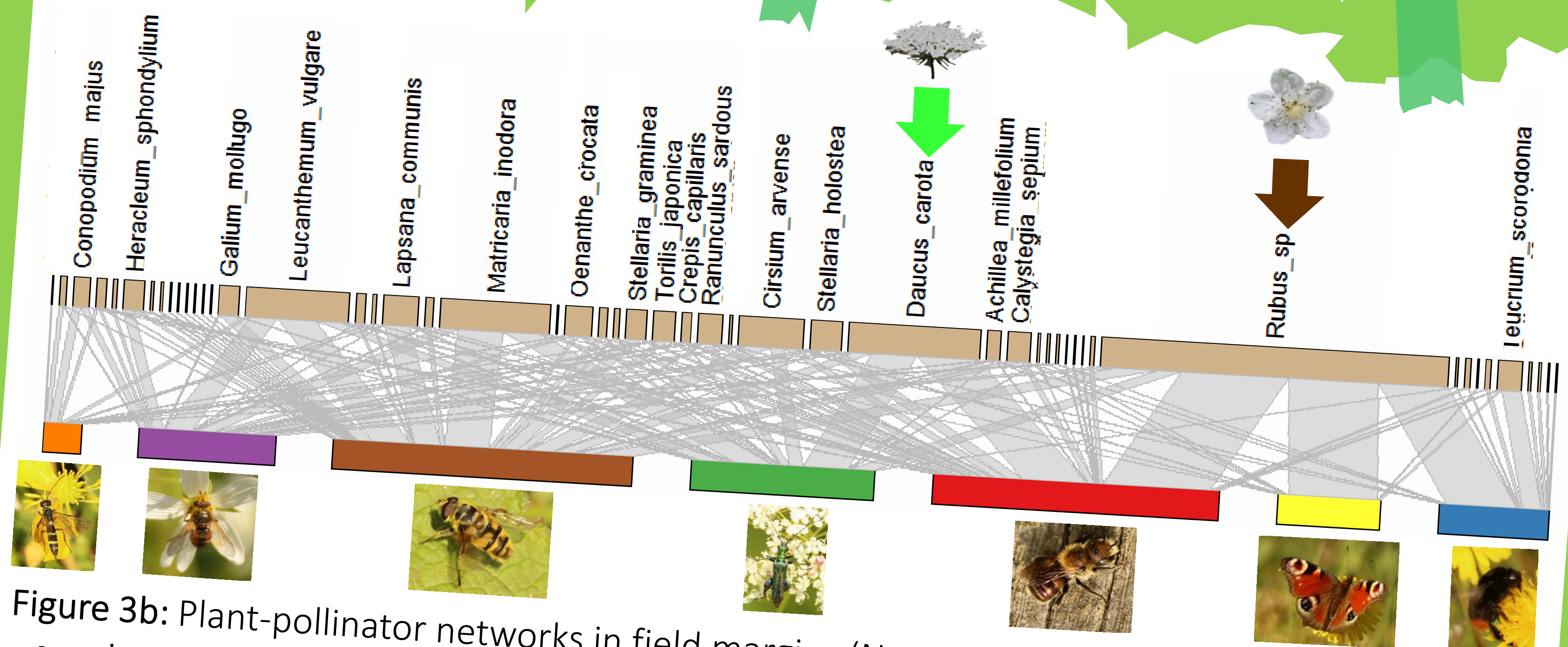
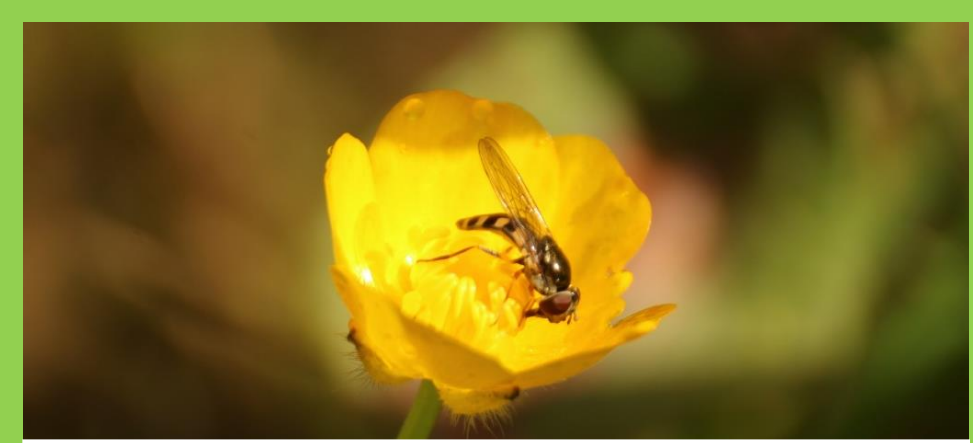


Figure 3b: Plant-pollinator networks in field margins (N = 883 interactions). Only the main plant species are named for visibility. Arrows show an example of herbaceous species (green) and woody plant species (brown) used by pollinators.



Interaction between a hoverfly and *Ranunculus repens*

- Plant pollinator networks are less complex in crop fields than in their adjacent field margins.
- In crop fields, one weed species (*Matricaria inodora*) plays an important role as a resource in the network. Cultivated plants (*Vicia faba* and *Pisum sativum*) are included in the network but are globally less important for pollinators than other weeds.
- In adjacent field margins, both herbaceous (e.g. *Daucus carota*) and woody plants (*Rubus fruticosus gr.*) are important for pollinators.

Conclusions and perspectives

- Allowing the maintenance of **weeds** in crop fields might be a promising practice to promote resources for pollinators in agricultural landscapes.
- **Mixed crops** - especially with faba bean – can fulfil resources to bumblebees, but are less used by other pollinators.
- It appears important to maintain flowering **woody and herbaceous plants** in field margins due to their positive effects on pollinators.

We studied the overall effect of plant diversification on pollinators but it seems important to better understand the variation in resource availability and their use by pollinators in space and time.

Reference

1. Isbell *et al.*, (2017). Benefits of increasing plant diversity in sustainable agroecosystems. *J. Ecol.*, 105:871-879.