

Hedges and flower strips promote plant-pollinator interactions without compromising apple flower visitation

Anne Mupepele, Vivien von Königslöw, Anna Bleile, Felix Fornoff, Jochen Fründ, Alexandra Klein

Hedges and flower strips next to crop fields can be beneficial for insects and crops. We investigate changes in plant-pollinator networks in apple orchards with and without adjacent hedges and flower strips before, during and after apple bloom.

1. Apple flower perspective Is apple flower visitation influenced by hedges and flower strips ?

2. Pollinator perspective Do apple pollinators (bees and hoverflies) benefit from hedges and flower strips before and after apple bloom?

Methods

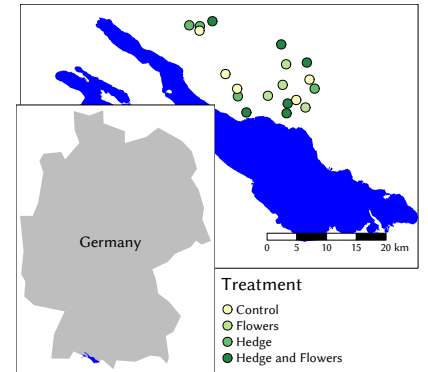
Apple orchards with four treatments



Pollinator observations



Study sites at Lake Constance



Analysis (1):

- Network index 'species strength' for apples. The species strength is high if every pollinator dedicates most of its visits to apples (in relation to other plant species visits)
- Bayes factor (BF₁₀): Comparing two linear models: 'index ~ 1' / 'index ~ treatment'
- Data: plant-pollinator interactions in orchards during apple bloom

Analysis (2):

- Network index 'generality' for apple pollinators. Generality can be high if there are few pollinator specialist species, as well as if pollinators visit many flower species evenly
- Linear mixed model (LMM): 'index' ~ treatment + month
- Data: plant-pollinator interactions of apple pollinating species in orchards, hedges and flower strips from March to August

Fig. 1 Location of apple orchards used as study sites. Colours of sites reflect the four different treatments

Results

1. Apple flower perspective

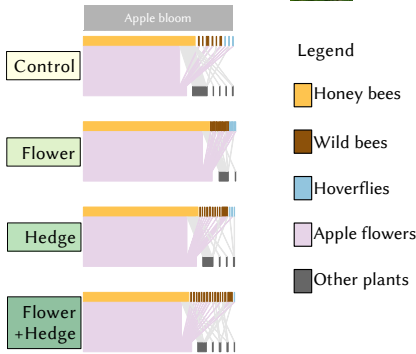


Fig. 2 Plant-pollinator networks during apple bloom

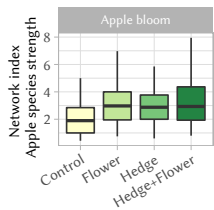


Fig. 5 Apple species strength does not change with treatment, BF₁₀ = 1.04

Apple flowers are visited equally well in all treatments

2. Pollinator perspective – apple flower visitors

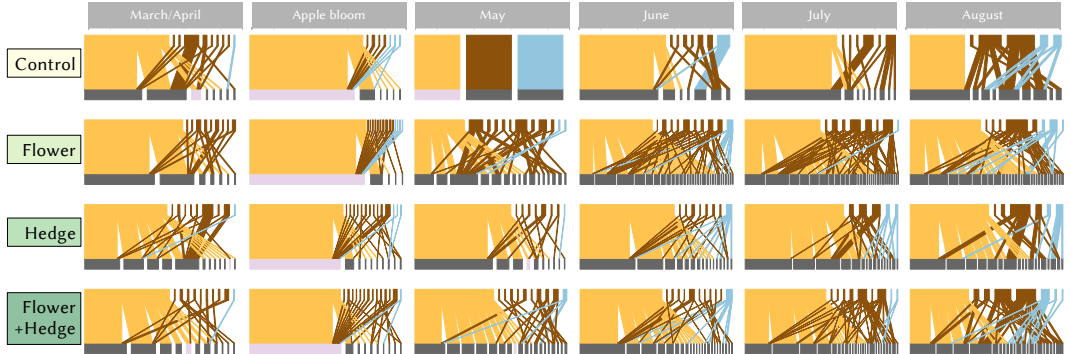


Fig. 3 Plant-pollinator networks from March to August highlighting interactions of pollinators

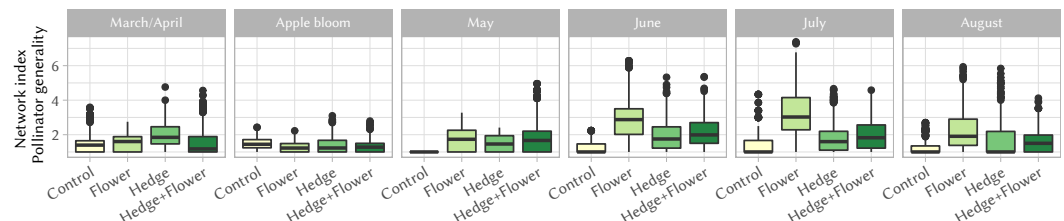


Fig. 6 Pollinator generality changes with month and treatment
LMM: Month $F = 2.86, p - value = 0.019$; Treatment $F = 3.2, p - value = 0.0482$; (interaction not-significant)

Pollinators of apple flowers benefit especially from flower strips after apple bloom

Conclusion

Hedges and flower strips are beneficial for apple pollinators, but there are no differences regarding apple flowers visited in orchards.

