Organic hay fields as a floral resource for bees and other flower-visiting insects



By Beate Strandberg[1], Yoko L. Dupont[1] and Karen Soegaard[2], [1]Aarhus University, Department of Bioscience; [2]Aarhus University, Department of Agroecology

Bees and other flower-visiting insects are experiencing periods of food shortage, particularly in intensively managed agricultural landscapes in Europe.

As part of the Danish project EcoServe we therefore investigate whether increased richness of selected herbaceous species in organic hay fields acts as a floral resource thus enhancing abundance and biodiversity of pollinators.


Honeybee visiting Dandelion

Archived at http://orgprints.org/26601

An investigation of the relationship between diversity of bee-plants and pollinators in 20 organic hay meadows of different age revealed a positive correlation; hence, high diversity of pollinators is related to high diversity of bee-plants (Figure 1). Bee-plant diversity was measured as the number of flowering insect-pollinated plants, and pollinator diversity was measured as number of flower-visiting insects. Pollinators encompassed bees (wild bees and honeybees), butterflies and syrphid flies. The hay fields were located in six geographically isolated areas in peninsular Jutland (Denmark), which may be assumed to have independent pollinator faunas. Figure 1 shows that the relationship between bee-plant and pollinator diversity varies among sites (different slopes of the regression lines).

Impact of the surrounding landscape

The pollinator fauna at a given site is influenced by habitat type, and hence the potential pollinator fauna and pollinator diversity of a hay field is highly affected by the surrounding landscape. The hay fields in the Harbovad area were embedded in a much more heterogeneous landscape in terms of different types of biotopes (forest, shrub, grassland etc.) than the fields in the Bording area, which were much more homogenous. Moreover, the landscape at Harbovad contained more habitat types rich in floral resources, and this may explain the relatively high diversity of pollinators (Fig. 1).

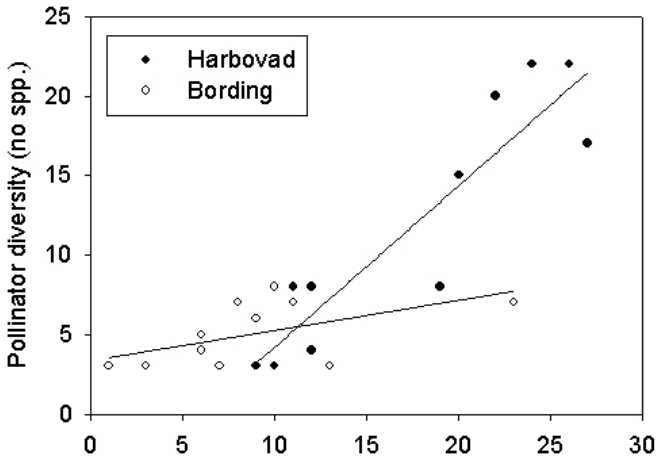
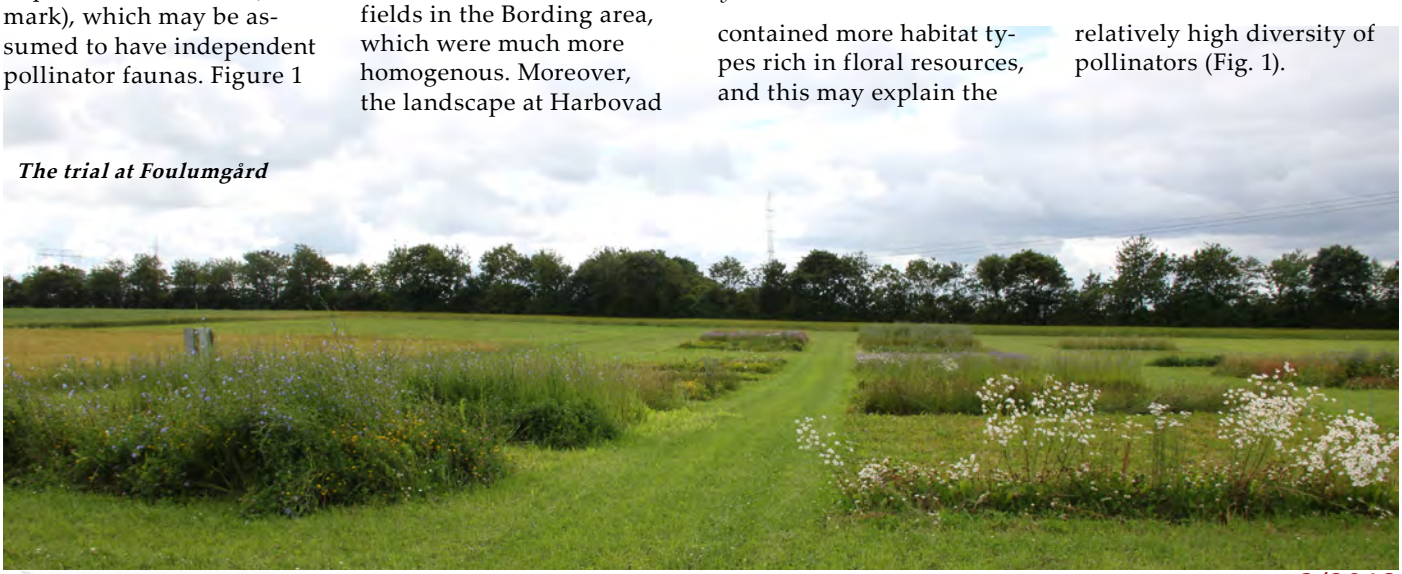


Figure 1. Relationship between number of flowering bee-plants and number of insects visiting flowers in three hay fields in Harbovad and 3 hay fields in Bording, both areas are located in central Jutland (Denmark). The plots are based on data collected on four occasions during the flowering period from late April to late August. The hay fields in both areas are aged 3, c. 10 and >50 years.

The trial at Foulumgård



	April	May			June			July			August		
	u	p	m	u	p	m	u	p	m	u	p	m	u
Dandelion													
Cumin													
Ribwort plantain													
Salad burnet													
White clover													
Bird's foot trefoil													
Field scabious													
Common yarrow													
Red clover													
Chicory													
Phacelia													
Chives													
Alfalfa													
Sainfoin													

Figure 2. The flowering period for the herbaceous plants used for experiment at Foulumgård (Denmark). Data are collected in unmowed monoculture plots, i.e. without interspecific competition. Dark grey indicates the main flowering period, light grey indicates periods with fewer flowers.

Increasing floral resources in the landscape – how?

High bee-plant diversity in the abovementioned hay fields may be a consequence of continuous and low intensity hay field management (> 5-10 years of continuous low intensity management). In general, diversity of bee-plants was low in regular hay production fields. Regular hay fields were characterized by short rotations, typically 3-4 years, and frequent cuttings during the summer. Our results suggest that time since last rotation and extensive management, including few cuttings and late first cut (ultimo June-primo July), is a prerequisite for high diversity of bee-plants and pollinators.

In EcoServe, we also investigate whether the addition of bee-plants to grassland mixtures enhances flower availability to pollinators.

At the experimental farm Foulumgård, we are collaborating on an experiment in which flowering patterns and biomass production are tested for a number of herbaceous plants. Among others, the plant species were selected based on their quality as a food resource for pollinators and also to obtain a continuous flowering from April to September in order to avoid periods of food shortage for pollinators.

In the experiment, we tested the effect of different cutting regimes (number and timing of cuttings) on flowering patterns. Furthermore, we tested how flowering is affected by competition when the plant species grow in multi-species mixtures compared to monocultures.

The tested species

The tested species showed continuous flowering without cuttings (Figure 2). However, the majority of the tested plant species did not flower after the first cut (Figure 3), and frequent cuttings (app. 4 weeks between cuttings)

Mining bee Andrena hattorfiana visiting Field scabious

White tailed bumblebee Bombus lucorum visiting Phacelia

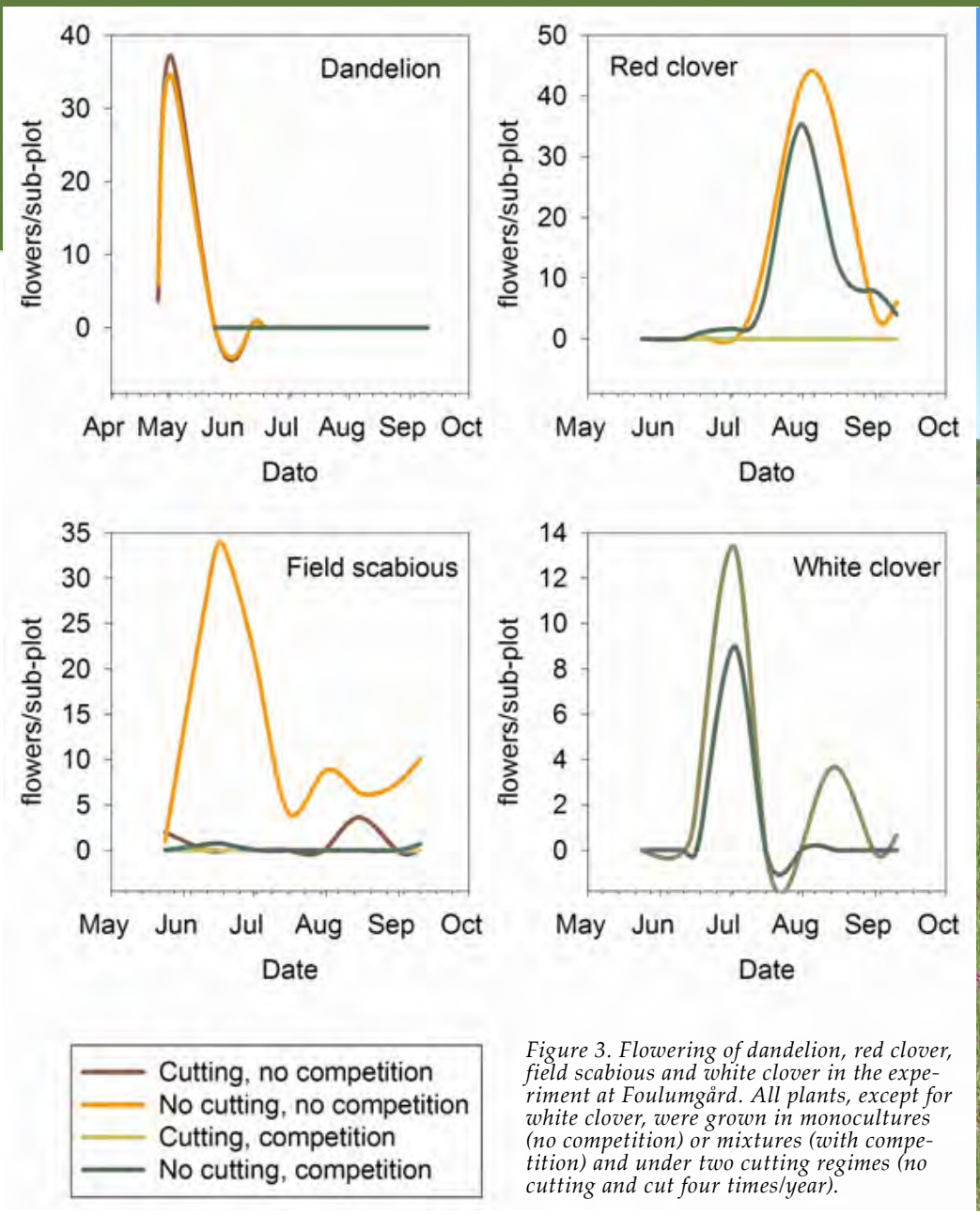


Figure 3. Flowering of dandelion, red clover, field scabious and white clover in the experiment at Foulumgård. All plants, except for white clover, were grown in monocultures (no competition) or mixtures (with competition) and under two cutting regimes (no cutting and cut four times/year).

will result in very limited floral resources. Valuable bee plants, such as phacelia and chicory, do not flower after cutting. Furthermore, phacelia is competitively inferior to other plants and, therefore, cannot be grown in grasslands, but may be sown in e.g. flower strips and field margins, which are not mowed. Species such as field scabious, red clover, bird's foot trefoil, ribwort plantain and cumin set few flowers after cutting. But these species are competitively strong and grow well together with other species in multi-species mixtures.

Dandelion is an example of an early-flowering species in which flowering is completed before the first cutting. Of the tested species, only white clover flowered shortly after cutting, and flowering may even be stimulated by mowing (Figure 3). Traditional grasslands which are frequently mowed will be poor in flowers. Thus, other management strategies are needed to enhance conditions for pollinators. In general, it is important to leave unmowed flower-rich areas in the fields throughout the flowering season to avoid periods of food shortage.

New suggestions

The experiment at Foulumgård showed that several herbaceous species, including red clover, bird's foot trefoil, ribwort plantain and chicory, were competitively strong and flowered well in multi-species mixtures when no cutting occurred. Hence, unmowed margins or "islands" consisting of such mixtures may provide a flower-rich resource for pollinators.

The biomass of these multi-species mixtures harvested at the end of the growing season turned out to be surprisingly high and of the same size as the total biomass of the individual species from four cuttings distributed over the season. Thus, there is potential to exploit the final biomass in bio-production.

More information

Read more about the Organic RDD project EcoServe at: http://www.icrofs.dk/Sider/Forskning/organic-rdd_ecoserve.html

Organic RDD is financed by the Ministry of Food, Agriculture and Fisheries and coordinated by ICROFS.