Do weeds attract more insects than our cultivated plants?

Summary

There have been a number of studies that show some of our common weeds such as dandelion and ragwort make a vital contribution to supporting beneficial insects.

We wanted to see how well this could translate into a garden setting over the period of a year, so that gardeners would have a better understanding of some of the benefits brought about by common weeds.

The research question evolved from a series of meetings of a citizen science action group, comprising of a mixture of researchers, community gardeners and pritvate gardeners. A 'menu' of common weeds and cultivated plants was given to the participants and they monitored the flowering and the insects visiting these plants. The key points that we learned were:

1. A small number of comitted individuals made a total of 1696 counts on the plants!
2. Although the cultivated plants generally attracted more insects than the weeds, the weeds filled a very important niche of supplying pollen and nectar in early spring. A good food source at this time is vital for insects that are building nests.
3. Most of the weeds attracting insects were those found in lawns such as dandelions, daisies, clover and self-heal. Adapting a more relaxed mowing regime is an easy step people can take to boost biodiversity without needing to let their gardens become messy.
4. This was an experiment that required taking detailed counts over a longer period of time. It is difficult to maintain commitment over such an extended period. The poor weather in 2023 also meant that people were not finding many insects on their plants, so this was a further demotivating factor that meant many people gave up.
5. A survey of attitudes to weeds achieved a total of 287 responses, which will be presented in a separate report.

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Introduction

The area of domestic gardens in the UK is estimated to be 4,330 square kilometres (Thompson and Head 2020), which is slightly more than a fifth the size of Wales. There is plenty of work to suggest that the way these gardens are managed can have a strong influence on biodiversity outcomes (Loram et al. 2011, Pearce 2024, Gaston et al. 2005, Delahay et al. 2023). Weed management is a key part of this management and common weed species such as dandelions (*Taraxacum officinale*), creeping buttercups (*Ranunculus repens*) and nettles (*Urtica dioica*) commonly contribute to the species richness within the garden spaces so make an important contribution to biodiversity (Loram et al. 2008).
There is also work (Hicks et al. 2016, Balfour and Ratnieks 2022) to show that some of the most common weed species are highly effective in providing resources for insects, further contributing to biodiversity. This work (Hicks et al. 2016) showed that some of the most common weeds such as ragwort, common thistles and dandelions were much richer nectar sources than many common cultivated plants. Other work (Balfour and Ratnieks 2022) showed that weeds termed 'injurous weeds' by Defra were attracting twice the abundance and diversity of pollinating insects than mixes sown in the field intended to attract these insects.
The aim of this study was to compare the contribution that a number of key weeds found in the domestic garden made to attracting insects to a number of common flowering cultivated plants. We also wanted to examine gardeners' attitudes to weeds within the garden. This was examined through a survey that will be published in a separate report.

Methodology

This experiment was designed through a number of online 'Citizen Science Action Group' discussion meetings and consultation with gardeners who were supporters of the charity Garden Organic. Together they came up with a shortlist of the most common weeds and cultivated plants in the garden. The group also helped to design the questionnaire to survey gardeners attitudes to weeds.
Forms were sent out to 99 participants who signed up to take part.
Participants were asked to fill out the survey on their attitudes to weeds then monitor at least three weed species and three cultivated species throughout the year. The weeds and cultivated species were selected from a list, with participants encouraged to select the species from the top of the list, which were the most common species found in gardens.

Each month, participants monitored each species by taking counts for 5 minutes recording the numbers of beetles, bumblebees, honeybees , solitary bees, wasps, hoverflies and other flies. The plants were also ranked scored for profuseness of flowering on a scale of 0 – 3 (0= no flowers, 1 = 1 or 2 flowers, 2 = partially covered with flowers, 3 = abundant flowers) and the weather conditions recorded.

Results & Discussion

A discussion group of gardeners devised a list of common weeds and common cultivated herbaceous plants. These were then sent out to a focus group for further refining.
The list of the most common weeds that arose from the group in order from most common to least common is:

- Dandelion - Taraxacum officinale
- Stinging nettle - Urtica dioica
- White clover - Trifolium repens
- Daisy - Bellis perennis
- Yarrow - Achillea millefolium
- Chickweed - Stellaria media
- Self heal - Prunella vulgaris
- Ragwort - Jacobaea vulgaris
- Shepherds purse - Capsella bursa-pastoris
- Common speedwell - Veronica spp.
- Red dead nettle - Lamium purpureum
- Common knapweed - Centaurea nigra
- Creeping thistle - Cirsium arvense
- Spear thistle - Cirsium vulgare
- Redshank - Persicaria maculosa

The chosen cultivated plants were:

- Nasturtium - Tropaeolum spp.
- Lavender - Lavendula app.
- Marjoram - Origanum majorana
- Comfrey - Symphytum × uplandicum
- Common primrose - Primula vulgaris
- Sedum - Sedum spectabile
- Hellebore - Hellebore spp
- Marigold - Calendula spp.
- Sage - Salvia spp.
- Thyme - Thymus spp.
- Foxglove - Digitalis spp.
- Hebe - Hebe spp.
- Dahlia spp.

- Lungwort - Pulmonaria spp.
- Verbena bonariensis
- Golden rod - Solidago spp.
- Cone flower - Echinacea spp.
- Hollyhock - Alcea Rosea
- Phacelia - Phacelia tanacetifolia
- Sweet alyssum - Lobularia maritima
- Wallflower - Erysimum spp.
- Bergenia spp
- Marigold - Tagetes spp.
- Cyclamen (autumn) - Cyclamen coum / hederifolium

Response to experiment
Only 37 participants returned forms but those that took part were dedicated and returned a total of 1696 insect counts!
A 37% response rate is what might be expected from a project that required a good deal of commitment to take time monitoring and counting insects. Also, the dull cold weather in 2023, meant that insects numbers were low generally, so many people may have found that they spent a lot of time recording nothing, so became demotivated and gave up.

Due to the lower number of participants, it was only possible to evaluate plants that that were counted enough times to provide meaningful data. Therefore, the study focused on the most frequently reported species: dandelion, daisy, nettles, clover and self-heal of the weed species and lavender, marjoram, comfrey, pulmonaria and nasturtium of the cultivated species.

With such a small subset of plants, it is not possible to answer the question whether weeds generally make more of a contribution to attracting a diverse range of insects than cultivated plants in UK gardens. However, as the plants all commonly occur in UK gardens, we can draw some conclusions as to how they can be managed together to improve the biodiversity within our gardens.

Weather in 2023
Generally the weather conditions in 2023 were detrimental to insect numbers.
Spring began with a mixture of cold and warmer days in March and April followed by May that was warmer than average. A lack of sunshine (only 74% of average) got the season off to a slow start. The overall UK rainfall total in March was 155% of average, making it one of the wettest on record. These conditions are likely to be detrimental to social insects building nests and can have a knock-on effect on insects for the rest of the year.
Summer was generally wet and dull. June was the warmest month, breaking several temperature records, but July was very cool, dull and wet, experiencing more than twice the average rainfall in some areas. August was a slight improvement but still lacked

sunshine. Autumn provided some redemption with a warm and sunny September and early October, but this is a time when insect numbers are generally dwindling anyway.

Flowering

Plants were given a flowering score of 0 -3 with 0 being no flowering and 3 being profuse flowering. The abundance of flowers is vital for maintaining our insect populations which are in decline (Balfour et al. 2018, Carvell et al. 2006). In our study the data showed that that there was a trend for the five cultivated plants to produce more abundant flowers than the five weeds (see Figure 1). However, the weeds still made an important contribution. The important but often overlooked contribution of weeds for sustaining insect populations has been highlighted by other researchers (Balfour and Ratnieks 2022, Hicks et al. 2016, Wignall et al. 2023)

The weeds were important for providing flowers in the early spring during the March-April period. These weeds were filling a niche. Having a good supply of pollen and nectar in early spring is essential to ensure that queen bumblebees are able to build a good population of workers that can then sustain a nest through the year (Watrous, Duennes, and Woodard 2019). Most of the weeds in this group (dandelion, daisy, clover and self-heal) are species that you would find in a lawn, so with just adopting a less vigorous mowing regime, they can be grown without fear of leaving the garden untidy.

Of the weeds, dandelions and daisies produced most abundant flowers during March and April. Other studies have shown that many of the common plants growing in lawns that are considered as weeds are actually highly beneficial to pollinators (Larson, Kesheimer, and Potter 2014). Of the cultivated plants, pulmonaria provided plenty of flowers during this early spring period.

In summer, white clover and self-heal provided flowers during the months of June and July with nettles also providing flowers over an extended period from May – September. Of the cultivated plants, comfrey provided flowers during May, as did marjoram, nasturtium and lavender in June.

In the autumn, the weed species nettles, daisies and dandelions continued to flower into October, and all the cultivated plants except pulmonaria continued to flower during this period.

Participants commented on the low numbers of insects in their plants, and with a general setting of low numbers, the relative numbers of each plant are discussed. With low numbers of insects and low participant numbers, only broad conclusions can be drawn, and it is important not to read too much into small differences between counts.

Bumblebees

The cultivated plants in this study attracted more bumble bees than the weed species (Figure 1). However, it is important to note that the weeds still made a contribution. There are a range of bumblebees in the UK with different size mouthparts with preferences for different shaped flowers (Sikora, Michołap, and Sikora 2020). Longer tongued species such as the garden bumblebee (*Bombus hortorum*) may prefer more widely spaced tubular flowers such as comfrey whilst shorter tongued species such as the buff tailed bumblebee (*Bombus terrestris*) prefer shorter flowers that are in clusters (Carvell 2002) such as those in the daisy or carrot family. Of the weeds, dandelions and daisies attracted small numbers of bumblebees during March and April, whilst white clover and self-heal attracted them during June and July.

Of the cultivated plants, pulmonaria attracted bumblebees in March and April, with comfrey attracting good numbers in May and June. Marjoram, lavender and nasturtiums all attracted good numbers in June, July and August and into September.

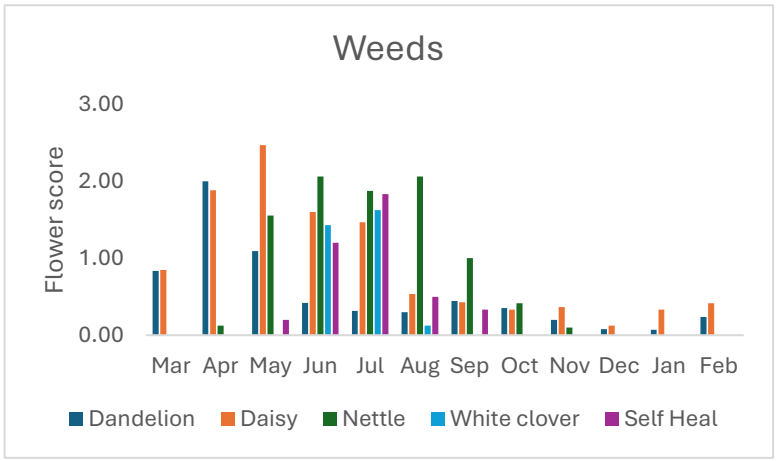
Honeybees

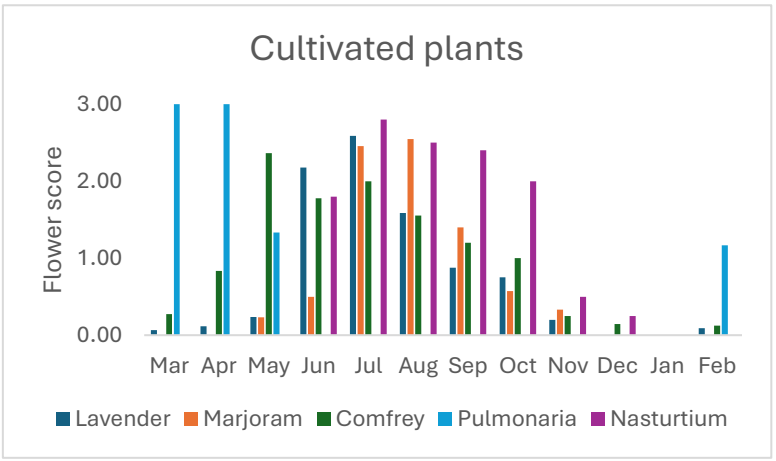
There were lower number of honeybees visiting weed species than for bumblebees, and again, daisies and dandelions made an important contribution in March and April (Figure 1). Honeybees have shorter tongues than most bumblebees so are more likely to show a preference for flowers with a more open structure and shallower corolla such as daisies, dandelions, marjoram and nasturtium (Comba 1999, Rollings and Goulson 2019). For the cultivated species, honeybees showed broadly the same trend, as for bumblebees with a main peak of activity in July and August.

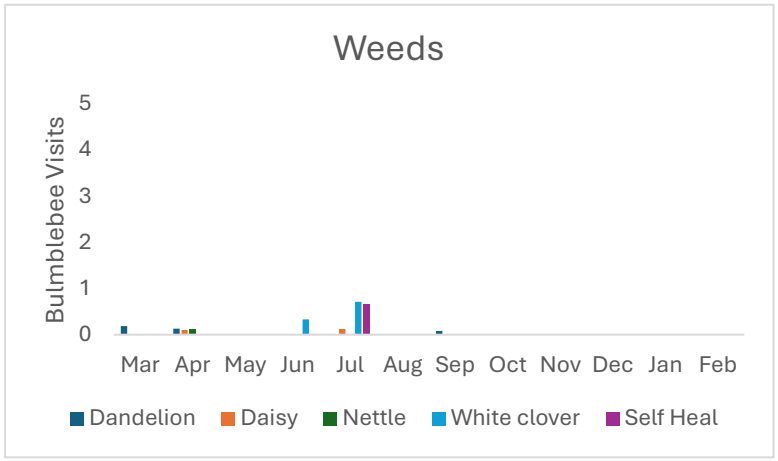
Hoverflies

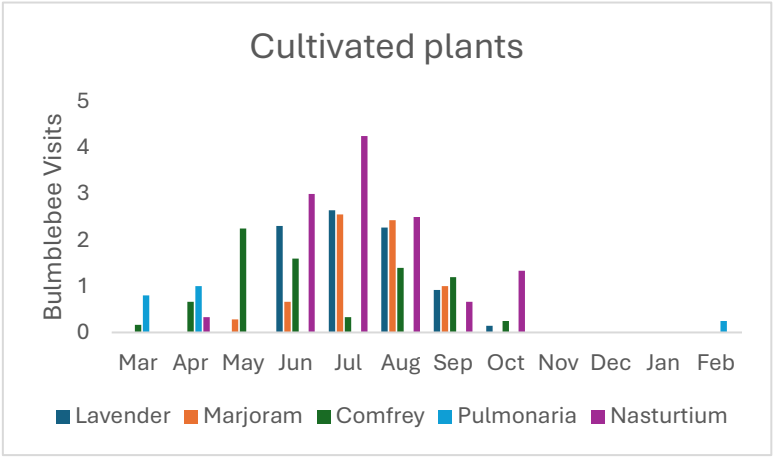
Hoverflies were more active in weeds than the honeybees and bumblebees (Figure 1). The dandelion and daisy weeds in particular filled an important niche in supporting hoverflies in the months of March and April when the cultivated plants were less active. It is important to build up good hoverfly populations early in the season so that they can lay eggs and build up good numbers of larvae on plants to control insect pests. The marjoram provided good support throughout the summer months of June, July and August. These plants all have short open structures which are more attractive to hoverflies which have short tongues (Rollings and Goulson 2019, Comba 1999).

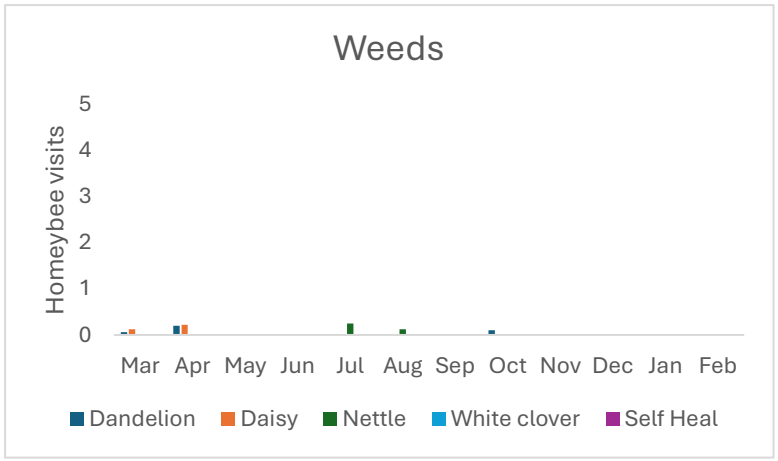
Figure 1 Flower scores and insect counts

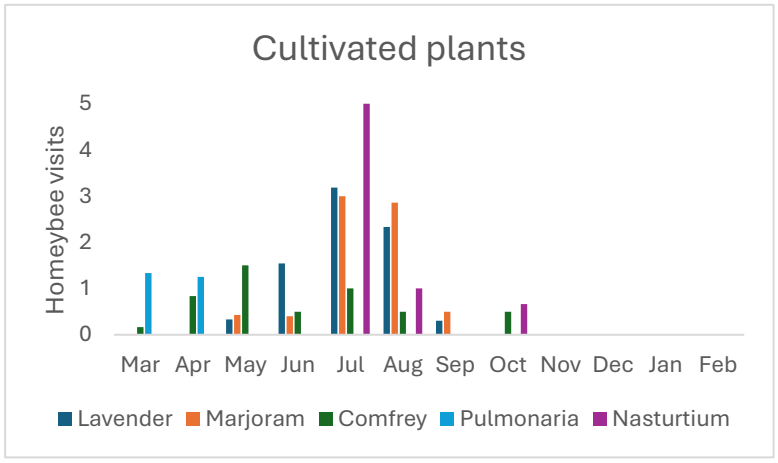


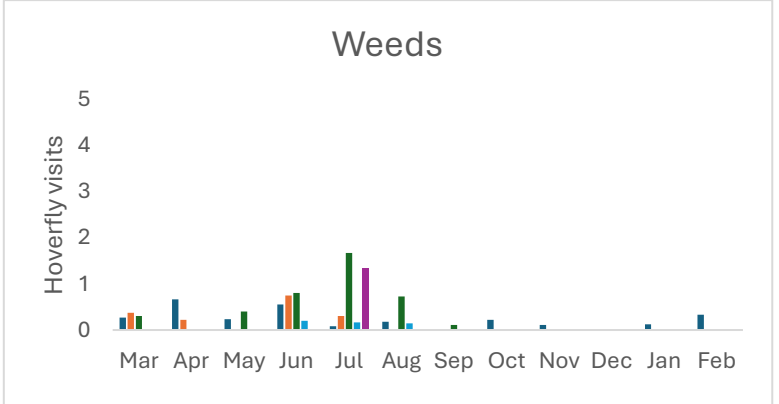


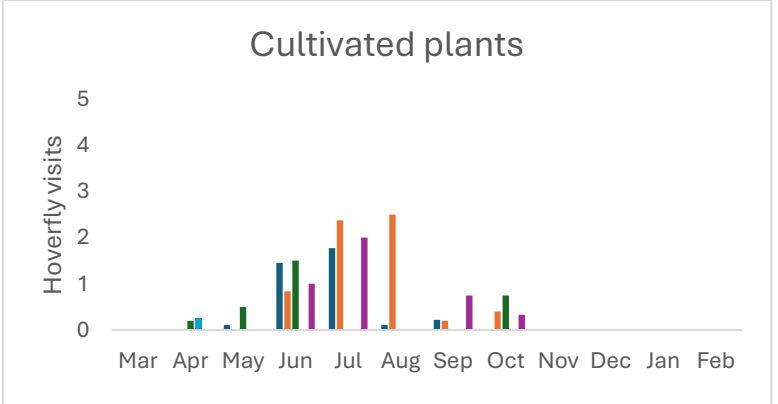












Summary of plants tested:

Period	Summary
Early spring weeds	Dandelions particularly good for hoverflies but also attracted bumblebees.
Early spring cultivated plants	Pulmonaria was excellent at attracting bumblebees and honeybees
Summer weeds	Self-heal and clover was good at attracting bumblebees, nettles and self-heal attracted hoverflies.
Summer cultivated plants	The lavender, marjoram, nasturtium and comfrey were all good at attracting bees and hoverflies at various points during the summer

Conclusion and recommendations

Although many of the cultivated plants attracted more bumblebees and honeybees than the weeds, weeds still played an important role in attracting beneficial and pollinating insects.

Weeds, particularly dandelions and daisies played an important role in attracting insects, especially hoverflies in the early spring in March and April.

Many of the weeds such as daisies, dandelions, clover and self-heal are commonly found in lawns, so by adopting a slightly less vigorous mowing regime or leaving some long patches of grass, we can make easily boost the insect life in our garden.

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