

RHS Plants for Bugs



Inspiring everyone to grow

Bulletin 3 – November 2019

Gardens as habitats for ground-active invertebrates

rhs.org.uk/plants4bugs

RHS Registered Charity No: 222879 / SC038262



RHS Plants for Bugs

Supported by the Wildlife Gardening Forum

According to the 2019 State of Nature report, 41 per cent of UK species studied have declined and 133 species have been lost since 1970. Studies showing invertebrate declines, including pollinators, frequently make headline news. Thankfully gardens are habitats where people help make a difference to these alarming trends. So understanding the role of the plants we grow in gardens is now more important than ever.

On the question of what to plant, it's often assumed that insects and other invertebrates that live in gardens are best supported by native plants, but is this true? Our research has shed new light on the plantings UK invertebrates prefer.

Summary

- ◆ Garden plants can support a wide range of ground-active invertebrates.
- ◆ The more densely you plant, the more invertebrates your garden will support, though sparser plantings may favour spiders.
- ◆ Native planting schemes, enhanced with native or non-native evergreens, will support the most ground-active invertebrates.

Recommendation

To support invertebrate abundance and diversity in gardens and other cultivated green spaces, choose plantings biased towards British native plants and encourage dense vegetation, while leaving some patches of bare soil. Near-native and exotic plants also have a positive role to play in providing a habitat for invertebrates, offering good evergreen winter cover and supporting pollinators when in flower.

Left. The entrance to the Plants for Bugs site at RHS Garden Wisley.

“The power of a garden lies in its very smallest inhabitants. Gardeners who look after them will have the greatest positive impact for biodiversity, helping to forge a new generation of wildlife champions.”

Andrew Salisbury, RHS Principal Entomologist

Background

Conducted over four years by RHS Science at RHS Garden Wisley, Surrey, and supported and inspired by the Wildlife Gardening Forum, Plants for Bugs was a unique field experiment, designed to test whether the geographical origin of garden plants affects the abundance and diversity of invertebrate wildlife they support.

Experimental set-up

The project consisted of 36 plots (each 3 x 3m, the size of a typical garden border) on two sites, one within RHS Garden Wisley and the other at the adjacent Deers Farm research field. Each plot was planted with a mixture (assemblage) of 14 plant species native to one of three geographical zones (treatments):

- ◆ British (native);
- ◆ northern hemisphere excluding British (non-native – northern; referred to as “near-native”);
- ◆ southern hemisphere (non-native – southern; referred to as “exotic”).

Each plant assemblage included bulbs, perennials, shrubs, a climber, and grasses and/or ferns, and was designed to appear as similar as possible in terms of plant height, density and position in the plots. The plots were managed as typical garden

borders and so were hand-weeded, watered, and cut back or staked where required. No pesticides were used on the plots. The study was designed to remove bias, and all protocols were developed along rigorous scientific lines.

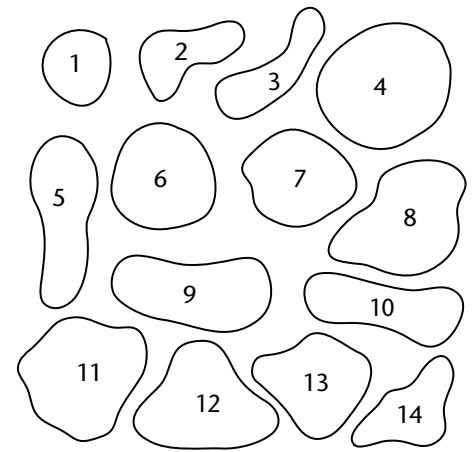
Sampling

Tens of thousands of invertebrates were recorded from all plots by several methods: from the ground using pitfall traps (covered in this bulletin); from the foliage using a Vortis suction sampler (insect vacuum); and from the flowers (pollinators) by visual observation. Sampling finished at the end of 2013.

Publication

The research is published in peer-reviewed scientific journals (see references, p.8), so will have been independently reviewed to ensure impartiality and accuracy. Each paper has also been summarised in a bulletin, to provide help to gardeners wanting advice on choosing a wildlife-friendly mix of garden plants. All findings and recommendations as a result of the study are available on the RHS website.

Clockwise from top right. The planting plan for each Plants for Bugs plot; priming a pitfall trap with a 50/50 mixture of water and antifreeze; separating and identifying captured specimens; a tray of labelled specimens.



What the research tells us

This bulletin is about the invertebrates found on the soil surface in gardens, collected from pitfall traps in the centre of each plot (p.3). It includes those that eat decomposing plant material (detritivores), those whose diet is plant material (herbivores) and those that feed on other invertebrates (predators). It does not include pollinators or plant-dwelling invertebrates – see bulletins 1 and 2 for these.

The importance of ground-active invertebrates

Plants form the basis of a garden's food chain as they do in all land-based ecosystems. The soil surface fauna of gardens consists of high numbers of detritivores such as woodlice and millipedes. These play a vital role recycling nutrients by feeding on decaying plant material and associated bacterial and fungal growths.

The soil surface is also a busy highway for invertebrates travelling from one resource to another, especially those that cannot fly or are less likely to, and so includes



herbivores (e.g. wingless weevils) that would otherwise be found on plants. Many predators are found on the soil surface, including spiders and carnivorous ground beetles. Some will be actively hunting other invertebrates, while others will be travelling from one area to another, and all help to feed vertebrates such as toads, mice and hedgehogs. Combined with an abundance of a wide range of invertebrates on plants, these are an

important part of a healthy balanced garden ecosystem.

Key findings

- ◆ Overall, the denser the vegetation, the higher the ground-active invertebrate abundance regardless of plant origin. A notable exception is ground-active spiders, which were found in greater numbers among sparser plantings.
- ◆ The best strategy for gardeners wanting to support ground-active invertebrates in gardens is to densely plant with more native and near-native plants than exotic plants.
- ◆ Planting schemes based on exotic plants may support relatively more ground-active invertebrates in winter than British native or near-native planting schemes. This is possibly related to the higher proportion of evergreens available in hardy exotic plantings.
- ◆ Planting schemes based on native plants may support a greater abundance of ground-active herbivores than other planting schemes, but ground-active detritivores show no preference for plant origin.
- ◆ Species diversity appears to be reflected by invertebrate abundance: as invertebrate abundance increases so does the diversity of species.



We would emphasise that this interpretation is for those choosing plants for ornamental plantings in the UK. Outside of the managed ornamental garden, for example managing semi-natural habitats where the conservation of native habitat and species are the primary concern, different criteria apply.

“The best strategy for gardeners wanting to support ground-active invertebrates in gardens is to densely plant with more native and near-native plants than exotic plants.”

Plants for Bugs – Bulletins 1 & 2

Previously we have reported on pollinating insects (Bulletin 1) and plant-dwelling invertebrates (Bulletin 2). In summary, it was found that the best strategy for gardeners wanting to support invertebrates was to pack gardens with a range of flowering plants from different regions. While emphasis should be given to British native and near-native (other northern hemisphere) plants, exotic plants from the southern hemisphere have value as they extend the flowering season and provide some resource to non-pollinating invertebrate groups. Tolerating some nibbled leaves and allowing some plant debris to accumulate will support greater numbers of invertebrates.



How to apply this in the garden

1 The perfect cover – let planting fill out, but keep some areas sparser to help specific groups, notably spiders. Although not covered in this research, ground-nesting bees also make use of patches of bare ground.

2 More local – plant densely with plenty of native and near-native plants to support the greatest number of ground-active invertebrates, but be prepared for more nibbled plants than with exotic plant schemes.

3 Winter protection – whatever the plant origin, try to include some evergreens in your garden to give shelter for invertebrates.

4 Decide priorities – choosing more exotics (especially flowering ones) in your planting scheme might mean it supports marginally fewer plant-dwelling and ground-active herbivores, but will mean potentially fewer nibbled plants and should help extend the season for pollinators.

5 Be bio-diverse – for rich species diversity, follow all previous Plants for Bugs recommendations for gardeners. And don't limit yourself to just a few different plants – this and other studies suggest the greater the variety of plants in a garden, the richer the diversity of invertebrates it will support.



What do we find in the undergrowth?

Plants are the basis of all land-based ecosystems, including gardens. The four primary invertebrate groups in this system are herbivores, predators, detritivores and omnivores. Here we look at their function in our gardens, where to expect them among garden plants and examples from each group recorded on the Plants for Bugs plots.

1 Leaves of trees and shrubs: adults of beetles, including leaf weevils



4 Decomposing organic matter: millipedes



6 Other ground-living invertebrates: centipedes

3 Rotting plant material in damp spots: woodlice and pill bugs



5 Grazing on fungi which are breaking down dead plant material: springtails



Herbivores (1 2)

These eat living plants. They can have chewing mouthparts (such as caterpillars and plant-feeding beetles) or sucking mouthparts (such as thrips, aphids and other plant-feeding true bugs). The group contains generalists which are able to feed on a wide range of plants and some very specialist feeders which only feed on a few plant species.

Detritivores (3 4 5)

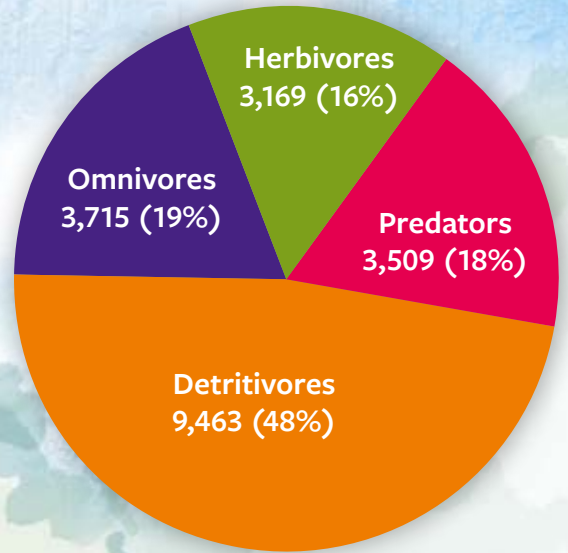
Detritivores feed on decomposing organic matter, of animal or plant origin. They are vital in recycling material in the garden. Many also feed on fungal and algal growths. This group includes springtails, woodlice and some beetles that feed exclusively on dead material.

2 The foliage of grasses and other plants in sunny spots: grasshoppers



9 Scavenging food of plant and animal origin: native dusky cockroach

7 Actively hunting for other invertebrates on open ground: wolf spiders



Pitfall catch over the four years of the project

8 Feeding on slugs and other invertebrates: rove beetles such as the devil's coach horse



10 Feeding on other invertebrates and plant material: ground beetles such as the black clock

Predators (6 7 8)

Predatory invertebrates eat other invertebrates. This group includes the predatory beetles (e.g. rove beetles), some true bugs, spiders and parasitoid wasps (parasitoids kill their host, while parasites usually do not). They are vital in any healthy ecosystem and help keep some problematic invertebrates in check, including many herbivores.

Omnivores (9 10)

Omnivores feed both on plants and invertebrates. This broad feeding strategy makes them very adaptable if one food source becomes scarce. This group includes native cockroaches (which are never pests indoors) and some ground beetles, which feed on other invertebrates such as vine weevil larvae as well as seeds and other plant material.

Dense versus sparse planting

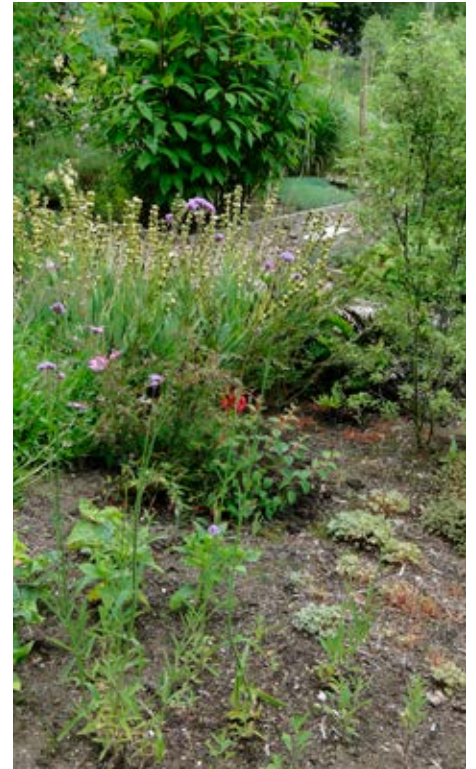
Findings from this study consistently show the greater the volume of vegetation, the more invertebrates it will support. One notable exception from the ground-active invertebrates is spiders, which were found in larger numbers where plots were less densely planted; this may suit these creatures' foraging behaviour. This demonstrates the value of leaving some bare or thinly planted ground in a garden, either in borders or on a patchy area of grass.

Value of evergreens

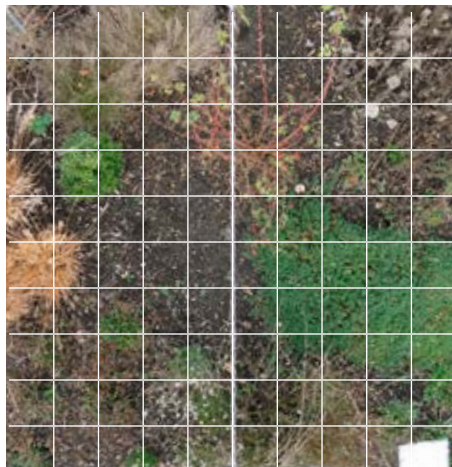
An interesting seasonal variation observed between the different plant groups related to ground-active invertebrates. Proportionally, they were more abundant in winter on the exotic beds compared to the native and near-native beds, most likely due to the higher proportion of evergreens within the exotic plant group.

A take-home message from this is to remember to include evergreens in all planting schemes to provide valuable winter cover. Useful examples of evergreens include native holly (*Ilex aquifolium*), yew (*Taxus baccata*) and butcher's broom (*Ruscus aculeatus*); near-native sweet box (*Sarcococca* species) and Mediterranean spurge (*Euphorbia characias*); and exotic *Pittosporum* and daisy bush (*Olearia* species).

“Remember to include evergreens in all planting schemes to provide valuable winter cover.”



The plot in the foreground on the left is more densely planted than the plot on the right, and would be expected to support more invertebrates. However, ground-active spiders would probably be more numerous in the plot on the right.



3m

A bird's-eye view of seasonal variation (November) in two of the 3x3m Plants for Bugs plots, with a grid of 30 x 30cm squares superimposed. The native bed on the left has considerably less winter cover than the exotic bed on the right, which has a higher proportion of evergreens.

Acknowledgements

The authors (Helen Bostock and Andrew Salisbury) would like to thank all who have been involved in the project, including William Adam, James Backshall, Crystal Duncan, Carolyn Hewitt, Helen Latham, Linda Moyes, Judi O'Prey, Junko Radscheit, John Ricketts, Kathy Stones and Jenna Watt, who maintained the plots, and the members of RHS Garden Wisley Curatorial staff who assisted. Thanks are also due to those who provided help and advice, including David Brooks, Suzanne Clark, Gerard Clover, Victoria Coupland, Colin Crosbie, Jonty Denton, Jim Gardiner, Alistair Griffiths, Andrew Halstead, Alison Haughton, Laura Hoy, Jeremy Kirk, David Notton, Juliet Osborne, Claire Ozanne, Peter Shaw, Sián Tyrrell, Ian Waghorn and Roger Williams. We are especially grateful to Steve Head and the Wildlife Gardening Forum (wlgf.org) for their inspiration and support. Layout and design: Richard Sanford (RHS).

To find out more, contact science@rhs.org.uk or RHS Gardening Advice, RHS Garden Wisley, Woking, Surrey GU23 6QB. Photos © RHS except cover (springtail, *Isotoma* sp.: Tim Garlick), 6–7: weevil* (Hectonichus), pillbug** (Franco Folini), springtail (Tim Garlick), grasshopper** (Aiwok), cockroach† (Dehio), wolf spider† (A. Balodis), black clock beetle‡ (Mick Talbot). Illustration (6–7): Andy Clayden. * Under CC BY-SA 3.0 ** GNU FDL † CC BY-SA 4.0 ‡ CC BY 2.0.

References

- Salisbury, A., Al-Beidh, S., Armitage, J., Bird, S., Bostock, H., Platoni, A., Tatchell, M., Thompson, K. and Perry, J. (2019). Enhancing gardens as habitats for soil surface-active invertebrates: should we plant native or exotic species? *Biodiversity and Conservation*. (<https://bit.ly/2sinFDA>)
- Salisbury, A., Al-Beidh, S., Armitage, J., Bird, S., Bostock, H., Platoni, A., Tatchell, M., Thompson, K. and Perry, J. (2017). Enhancing gardens as habitats for plant-associated invertebrates: should we plant native or exotic species? *Biodiversity and Conservation* (<http://bit.ly/2w1Kl62>).
- Salisbury, A., Armitage, J., Bostock, H., Perry, J., Tatchell, M. & Thompson, K. (2015). Enhancing gardens as habitats for flower-visiting aerial insects (pollinators): should we plant native or exotic species? *Journal of Applied Ecology* 52: 1156–1164 (<http://bit.ly/2w1zkXU>).