



Garden Herbivores¹

Ken Thompson

Most plant material may be recycled after it's already dead, but that doesn't mean there aren't plenty of animals queuing up to eat it while it's still alive.

Molluscs

Top of most gardeners' hit list are slugs and snails – surprising, really, since most molluscs are harmless consumers of dead plants and animals and only a few cause real problems. More than most garden animals, the importance of slugs and snails varies enormously from place to place and from time to time. This is because molluscs, rather like crustaceans, are most at home under water, and even the terrestrial kinds are only really happy if it's cool and damp. So while some gardeners on heavy soils are driven to despair by slugs, others on dry, sandy soils wonder what all the fuss is about. Before getting too mad with slugs, gardeners should also reflect that there are many plants they don't like to eat – a recent study found that the common garden snail refused to eat almost half of the native British plants tested. Here again we see the influence of the high fertility of most garden soils: if slugs are seen as a problem in gardens, that's only because we often choose to grow the kind of tasty, fast-growing plants they like.

Bugs

But most garden herbivores are insects, and they fall neatly into two kinds – suckers and chewers. The suckers are simpler, since almost all are in a single order, the Hemiptera or bugs. Bugs are very diverse, with around 1,700 species in Britain, but all share mouth parts modified into a piercing tube, like a tiny hypodermic needle. Bugs include the most abundant plant-eaters in the garden, the aphids. Aphids graphically illustrate a key feature of most ecosystems, which is that plants are often short of nutrients, but commonly have too much carbon. Thus aphids need to process great volumes of plant fluids to obtain enough protein, and often excrete the surplus sugar as honeydew. Honeydew attracts ants, social wasps, flies and even bees, but much of it ends up on cars and garden furniture, much to the annoyance of gardeners. Other bugs – froghoppers (or spittle-bugs) – have found another use for all that spare fluid; the nymphs blow bubbles out of their backsides and hide in the resulting froth (cuckoo-spit). Aphids have few redeeming features, but many larger bugs are handsome insects, and good but rather noisy and erratic fliers. The hawthorn shield bug (*Acanthosoma haemorrhoidale*), a glossy green and bronze bug with distinctive pointed 'shoulders', is common in many gardens.

Chewing herbivores

Chewers are much more diverse, and often cause obvious damage, leaving signs of their activity in the form of holes in leaves. Among the insects, the three major groups of chewers, each with species regarded as pests by most gardeners, are beetles, sawflies and Lepidoptera (moths and butterflies). In many cases, the adults don't eat plants at all, and even if they do, it's usually the larvae (caterpillars) that do most damage, since this is the part of the life cycle that does most of the growing, and therefore most of the eating. Caterpillars are abundant, but

surprisingly hard to spot; they have plenty of enemies, and one of the best defences is simply staying out of sight. If a caterpillar is brightly coloured, for example the mullein moth, that's a sure sign it doesn't taste good. Many spend all or most of their lives concealed inside plant stems, seed heads, or even inside trees, living or dead. Wood is a very poor food, so such larvae develop only slowly and may take many years to reach maturity, but their reward is protection from most (but not all) predators. One group of specialist wood feeders is the longhorn beetles, large, handsome beetles with long antennae. Most are quite rare, but the wasp beetle is not uncommon in gardens.

Leaf miners

All insect herbivores are small, which opens up the possibility of lifestyles that simply aren't an option for larger animals. The larvae of around 500 British moths, beetles and flies live inside leaves. Such larvae are known as 'leaf miners', and although the adult insects themselves are rarely seen, the mines may be conspicuous. One familiar garden example is the holly leaf miner, while another is occasionally a pest of beetroot (both these are flies). Most native leaf miners are specific to native plants, but some exotic garden plants have brought their miners with them; the firethorn leaf-miner (*Phyllonorycter leucographella*, a small moth) was introduced into Essex sometime in the 1980's and can now be found making obvious mines on the upper surface of pyracantha bushes throughout England.

Galls

Some other insect chewers have gone further and have persuaded plants to provide a bespoke residence and food supply, all rolled into one: these are the gall-formers. The insects responsible for most galls, including marble and spangle galls of oak and robin's pincushion on wild roses, are the gall wasps. Gall wasps are tiny and have weird and wonderful life cycles, involving alternating sexual and parthenogenetic generations. Parthenogenesis involves reproduction without sex, in which females produce exact copies of themselves. Plant galls are mini-ecosystems in their own right, supporting flies, moths and other gall wasps that don't make their own galls, but lay their eggs in the galls formed by other species. This behaviour is not strictly parasitism, but they may accidentally cause the death of the rightful owner.

Pollinators

Plenty of insects may pollinate flowers from time to time, but there are three great groups of garden pollinators: hoverflies, moths and butterflies, and bees. The first two have larval stages that do not depend on flowers. Young moths and butterflies eat plants, and it's a sad fact that if you like to see the adults in your garden, you will have to put up with their delinquent offspring. There are many more large moth species than butterflies, in fact the ratio is about 35 to 1. Most moths fly at night, but there are even more day-flying moths than butterflies. All moths and butterflies have a long proboscis and can extract nectar from deep flowers, so to keep them happy, grow buddleia, hebe, honeysuckle, verbena, red valerian, lavender, Michaelmas daisy, ice-plant and teasel.

Moths and butterflies sip nectar, but hoverflies eat nectar and pollen, while their larvae are quite varied in their habits. Some eat rotting plants in dung, decaying matter or water, many eat aphids, and one (the narcissus fly) is a minor pest of garden bulbs. Although many are important aphid predators, the legless, maggot-like larvae of hoverflies probably go unnoticed (or if noticed, unrecognised) by most gardeners. Hoverflies are extremely abundant in gardens, showing just how good gardens are for pollinators; in the BUGS study, hoverflies were the second most abundant group of flying insects, after parasitoid wasps.

Hoverflies: evolution in action

Many insects have come to resemble each other ('mimicry'), for two rather different reasons. Animals that taste bad benefit if they all share similar 'warning colours', so that predators soon learn to avoid all such animals (*Müllerian mimicry*, after Fritz Müller who first described it). Warning colours usually involve some variation on black and yellow, or black and red; social wasps and ladybirds are good examples. However, adult hoverflies exhibit a quite different kind of mimicry (*Batesian mimicry*, after English naturalist Henry Bates); hoverflies are both tasty and harmless, but mimic insects that either sting, or taste bad, or both. Some resemble bees, but most common hoverflies are wasp mimics. The trouble is, Batesian mimicry only works well if the palatable mimic isn't too common relative to the nasty 'model' (if predators encounter too many tasty mimics, they begin to lose their automatic fear of warning colours), and in gardens, this is no longer true. By providing abundant food for both larvae and adults, gardens are almost perfect hoverfly habitat, and hoverflies now outnumber social wasps in gardens by about ten to one. Hoverfly mimicry took millions of years to evolve, but under modern conditions we may now start to see it begin to disappear².

Social bees

Bees, the only insects in which all stages of the life cycle are totally dependent on flowers, are the ultimate pollinators. Among social bees, which make communal nests in which there is division of labour between a reproductive queen and sterile workers, both honeybees and bumblebees are abundant in gardens. Honeybees make permanent nests (hives) and many garden visitors will be from commercial hives, but bumblebee nests are annual affairs, each one founded in spring by a single queen. Because they are much smaller than honeybee hives, bumblebee nests often go unnoticed, but recent research suggests there may be at least one nest in up to half of all gardens³. The seven common garden bumblebees all have slightly different preferred nesting sites, but long grass, compost heaps, bird boxes, hedges and garden buildings are all favoured sites for one or more species. On the other hand, flower beds, lawns and excessively tidy gardens in general provide few nesting sites. Owing to the desire of most gardeners for lots of flowers over a long season, gardens are already excellent bumblebee habitat, but if we were able to provide more nesting sites, bumblebees might be even more abundant in gardens. Our six common native bumblebees have been augmented by the recent arrival of the tree bumblebee from mainland Europe. Spreading rapidly, this species is already one of the commonest garden bumblebees, and frequently nests in boxes provided for hole-nesting birds.

Solitary bees

Solitary bees, as their name suggests, do not make large communal nests – each female makes a small nest in which she lays just a few eggs, provisioned with nectar and pollen. There are many species in gardens (37 in Jennifer Owen's Leicester garden), but most are small and not very abundant, so few gardeners notice them. Nests may be in hollow stems, dead wood, walls or in the ground – the small 'volcanoes' of soil excavated by *Andrena fulva*, the tawny mining bee, are not uncommon in lawns in spring. Leaf-cutter bees often take neat pieces of rose leaf to make their nest cells. Many solitary bees will use artificial nests, again suggesting that their numbers in gardens might be limited by the availability of nesting sites rather than food.

Cuckoo bees

One feature of all ecosystems is that natural selection is always on the look-out for a free lunch. Among both bumblebees and solitary bees, 'cuckoo' bees cheat by laying their eggs in

the nests of other bees. Cuckoo bumblebees usually kill the host queen and then take over, relying on the host workers to feed and tend their young. In Jennifer Owen's garden, six species of bumblebees and seven species of solitary bees were cuckoos. Cuckoos are always much less common than their hosts, and – because they don't have to waste time collecting pollen – are also always less hairy.

¹ Reviewed by Steve Head

² Azmeh, S., et al. (1998) Mimicry profiles are affected by human-induced habitat changes. *Proceedings of the Royal Society of London Series B-Biological Sciences*, 265, 2285-2290

³ Osborne, J.L., et al. (2008) Quantifying and comparing bumblebee nest densities in gardens and countryside habitats. *Journal of Applied Ecology*, 45, 784-792.