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Is your garden buzzing?

Tim Riggs explains why gardeners need to protect pollinating insects, and suggests how

Fig. 1 Honeybee, *Apis mellifera*.

One of the dreamy delights of a garden is the sound of buzzing insects as they move from flower to flower, gorging on nectar and transferring or collecting pollen. If we like to save our own seed, or wish to encourage self-seeding, these pollinators are welcome agents of fertilisation, and of course they pollinate our apples, pears, plums and raspberries, but whether we benefit directly or not, we can enjoy their presence. A garden devoid of bees, hoverflies and butterflies is unthinkable.

Although insect populations often fluctuate dramatically from year to year, there is now substantial evidence of a serious continuous decline in pollinating insects in many regions of the world.

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Fig. 2 Small garden bumblebee, *Bombus hortorum*. This long-tongued species is especially attracted to red clover.

In Britain since the 1950s, there has been a decrease in the range and number of species of bumblebees, solitary bees, butterflies and moths. The population of honeybees may have declined by as much as 75% over the last century.

The fate of the honeybee, *Apis mellifera* (fig. 1), one of our principal pollinators, is causing great concern globally. In America, newspapers reported the phenomenon of Colony Collapse

Disorder (CCD) in 2007; in the same year in the UK, government inspectors reported a 25% decline in honeybees, although this was not officially attributed to CCD. Much research work is now devoted to determining the likely reasons for these declines.

The situation is complicated, and some causal factors may not apply to all types of bee, or to all countries, or even to different parts of the same country. However, there seems little doubt that change in land use is one of the most important factors. Modern intensive agriculture, involving large areas of monoculture, has led to a landscape that is no longer bee-friendly.

Much of the wild flora has been lost or suppressed, with consequent lack of diversity amongst the plants visited by bees. Applications of new nicotine-based pesticides such as Imidacloprid may be harming the bees themselves. In addition, the honeybee is under attack from the varroa mite, and only the treatment and care provided by beekeepers is keeping colonies alive. Most wild honeybee colonies are short lived.

Many of our rare and threatened plant species are insect pollinated, some perhaps by only a limited range of bees. If these bees become extinct, the plant species may fail to set seed and be lost also. Some wild plant species may already be in a downward spiral for this reason.

Insects pollinate many of the fruit, vegetable, oil, seed and nut crops that are a vital part of human diets worldwide, providing more than 90% of vitamin C. In terms of the production of commercial crops, the economic importance of bees can be estimated, but their value as pollinators of our wild and garden plants is less easily gauged.

Gardens and parks can be regarded as islands of biodiversity among urban buildings and tarmac, or among rural acres of monoculture crops. Their unique features are that plants can be chosen for aesthetic reasons, but also, without conflict, for the benefit of bees and other pollinating insects; and that they are unlikely to be contaminated with chemical pesticides.

There is no shortage of advice for choosing bee-friendly plants. Lists are published, but often with no accompanying evidence. A study by researchers at the Laboratory of Apiculture and Social Insects (LASI), University of Sussex, has shown that ornamental garden flowers vary greatly in their attractiveness to bees and other insects, and that lists of

Fig. 3 Common carder bee, *Bombus pascuorum*, on *Salvia* 'Hot Lips'

Fig. 4 White-tailed bumblebee, *Bombus lucorum*, has a short tongue, and favours shallow flowers like this geranium.

'bee-friendly' plants may be over simplistic and incomplete. For instance, asters are often included, but there are hundreds of varieties, and in a survey carried out at the National Collection of Asters at Picton Garden in Worcestershire, LASI researchers found that only a small proportion of varieties were highly attractive to insects, mainly hoverflies and honeybees.

Perhaps we need to learn for ourselves by observation, and to make the conservation of pollinating insects a key criterion in the design of our gardens and parks, along with all the other considerations such as plant structure, foliage and flower colour, and time of flowering.

In the Autumn 2012 *Hardy Plant*, Helen Mount listed the plants that had proved popular with different kinds of bees in her garden on the Isle of Wight. She encouraged us to take up the challenge and add to the list from observations in our own gardens as the basis for an information sheet to be posted on the HPS website.

First we should learn something about the bees in the British Isles, as these are the most important of our pollinators. As Helen discovered from her own research, there are about 20 species of bumblebee (probably 24, although only six of them are common throughout the country), and one species of the Western or European honeybee. The vast majority of our bee species (well over 200) are solitary – so-called because a single female nests alone, unlike bumblebees and honeybees, which nest in colonies and have a worker caste of sterile females.

Fig. 5 Queen red-tailed bumblebee, *Bombus lapidarius*, on an allium inflorescence.

Fig. 6 A red-tailed bumblebee on a rhododendron. Rhododendron is toxic to the western honeybee, but not to bumblebees.

All bees need nectar and pollen, and a place to nest. They may have evolved from a predatory wasp that lived in the Cretaceous Period, but they are now strictly vegetarian! The change probably happened 100–130 million years ago, corresponding with the period when flowering plants (angiosperms) became the dominant group of plants. Competition for insect attention probably facilitated the relatively rapid success and diversification of the flowering plants, and the ancestors of our insect pollinators would have correspondingly adapted to differing ways of gathering nectar and moving pollen, thus setting up the intricate co-evolutionary systems we are familiar with today.

Pollen is the male germplasm of plants, and therefore necessary for their reproduction, but many types of pollen have evolved also to be attractive to and edible by bees, and are produced in surplus. Nectar is produced in nectaries – active glands that are usually, but not always, near the base of the stamens, so that in reaching them, the insects are likely to pick up pollen

on their bodies, and also to transfer pollen from the same or another flower to the stigmatic surfaces, thus achieving pollination.

Nectar is basically a solution of sugar and water, varying in concentration and quantity depending on species, time of day and external conditions such as the weather. To the bees it represents the carbohydrate component of their diet and their source of energy. The main sugars are sucrose, glucose and fructose in proportions that tend to be characteristic of particular plant families. Many bees use nectar directly as it comes from the flower, but honeybees also process it into honey, which can be stored. A honeybee colony may need as much as 120kg nectar each year for active growth and development, and at least 16kg of honey stores to sustain a population of several thousand workers and the queen through the winter when foraging is not possible. Bumblebees and solitary bees need far less nectar, as they have annual lifecycles.

Pollen contains large amounts of protein, plus some fat, minerals and vitamins. The foraging bees themselves require little protein, but use it predominantly to feed their brood. Bumblebees and solitary bees feed pollen directly, often mixed with nectar, but honeybees treat it to prevent germination and prepare it for long-term storage as 'bee bread'. Young workers consume bee bread and secrete brood food for developing larvae. Pollen may be fed directly to older larvae, and newly emerged adults consume it to complete their physiological development. Young queens need it to develop their ovaries and lay eggs. An average colony of honeybees needs a minimum of 30kg pollen a year to be healthy. Research has shown that diversity of pollen in the diet benefits the bees' immune system, and it seems likely that this also applies to other bees.

Thus a mix of different flowers is better for bees than a large area of a single species.

Foraging bees learn which flowers are particularly good to visit and how to extract the nectar and pollen from those with complicated structures. An example is the snapdragon (*Antirrhinum*), whose nectar is concealed within the flower. A bumblebee has to learn how to open the flower, crawl inside and find the nectar. Bumblebees are also adept at 'tripping' the flowers of the pea family. Once a foraging bee has discovered how a flower functions, and how to get at nectar or pollen, it tends to visit these flowers repeatedly, a phenomenon known as 'floral constancy'.

Fig. 7 Hairy-footed flower bee (*Anthophora plumipes*) browsing on a pulmonaria.

This benefits the plants, because pollen is moved between flowers of the same species and not wasted on unrelated species. Honeybees can recruit other bees to visit the same flowers by using a coded dance back in the hive that tells other workers the distance, and the direction relative to the sun.

Different species of bumblebee show variation in the length of their tongues. Of the six most common species, two are long-tongued – the small garden bumblebee (*Bombus hortorum*) (fig. 2) and the common carder bee (*Bombus pascuorum*) (fig. 3) The garden bumblebee has a tongue roughly the length of its body (c. 13mm) and can reach nectar at the base of long floral tubes such as those of red clover, foxgloves and honeysuckle. The other four common bumblebee species – buff-tailed (*B. terrestris*), white-tailed (*B. lucorum*) (fig. 4), red-tailed (*B. lapidarius*) (figs 5 and 6) and early bumblebee (*B. pratorum*) – have shorter tongues and favour flowers with shorter floral tubes. This makes it difficult to generalize about which plants are best for bumblebees. That said, the shorter-tongued species may very often take a short cut – literally – by biting a hole at the base of a floral tube and 'robbing' the flower of its nectar through the back door, so to speak. Other relatively short-tongued bees, including the honeybee, will often rob flowers through these previously cut holes.

Fig. 8 Small garden bumblebee on a dandelion.

Fig. 9 Honeybee browsing on cherry blossom, a rich source of nectar early in the season.

Solitary bee species are mostly short-tongued, and forage from relatively open or short-tubed flowers, which are often of low reward. These bees fly quite slowly, and rarely forage more than a few hundred metres from their nest. In contrast, the long-tongued solitary bee species, such as the hairy-footed flower bee (*Anthophora plumipes*) (fig. 7) and the fork-tailed flower bee (*Anthophora furcata*), forage at deeper-tubed flowers, with richer nectar rewards. They are fast-flying, high-energy bees: the hairy-footed flower bee can forage up to 4km from its nest site.

How can we as gardeners use this information about the diversity of bees in our gardens to help them survive?

- Grow plants with a wide range of flower forms to attract and sustain different types of bees. Avoid double-flowered varieties as their stamens may be entirely converted to extra whorls of petals and their nectaries may

also be absent or difficult for bees to reach. (Many dahlia and chrysanthemum varieties have this feature, and although attractive to gardeners they are of no benefit to bees; this is a rare case where aesthetic considerations conflict with pollinator conservation.)

- Provide vital continuity of forage throughout the spring, summer and autumn.
- Grow patches of the same plant, rather than a single representative, to facilitate floral constancy of particular food sources.
- Never use pesticides on plants when they are in flower, and preferably not at all.

When choosing plants in a nursery or garden centre, notice which ones are attracting bees and hoverflies, and at what time of year. Also, think of buying several of the same plant, or of propagating, so that you can grow a sizeable patch that bees will recruit others to work on.

All three types of bee discussed here need nectar and pollen sources throughout the season. At the beginning of spring, in February–March, the emerging insect pollinators need rapid access to energy. Examples of good plants for this period include goat and grey willows (*Salix caprea* and *S. cinerea*), dandelion (fig. 8), blackthorn, hawthorn and fruit trees (fig. 9). Garden plants include aubretia, wallflower, heathers, crocuses, primroses and flowering currants.

The honeybee workers we see in the garden during the summer will live for only a couple of weeks, having spent the first two or three weeks of their lives on in-hive duties. However, those that develop in late summer and autumn follow a different pattern of aging. These are the bees which will store fat to help them survive the winter; for this they consume large quantities of bee bread. Queen bumblebees and queen solitary bees also need to build up supplies before hibernating through the winter.

Fig. 10 Ivy bee (*Colletes hederae*) photographed in Shropshire.

Fig. 11 In a Rugby park, a bank of meadow flowers provides floral constancy.

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Fig. 12 A lawn mown just once a year in autumn, providing nutrition for bees through the early and mid-summer.

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Fig. 13 Red mason bee (*Osmia rufa*) examining bamboo tubes in a bee wall.

An excellent late source of pollen and nectar is the common ivy. When autumn days are warm enough for honeybees to forage, ivy makes a valuable contribution to the hive's winter stores of honey and pollen. Bumblebee colonies have usually died out by this time, but the buff-tailed bumblebee has been seen on ivy during the winter in southern England – perhaps second-generation bees, made possible by milder winters. The ivy bee (*Colletes hederae*) (fig. 10) has a late flying season and ivy is its main source of pollen. This solitary bee is a relative newcomer in Britain, first recorded in 2001 in Dorset and now spreading more widely. Ivy can be a nuisance in gardens, often attaining huge dimensions, climbing up trees and scrambling over walls and fences, but think of the bees and don't be too hasty in removing it.

Any unproductive patches of ground could be planted with a meadow seed mix (fig. 11), or an area of lawn could be left unmown to allow plants like clover, dandelions and birdsfoot trefoil to flower (fig. 12).

If you keep, or wish to keep, honeybees, your local association will provide training on their husbandry and management. Other bees can be helped by conserving suitable areas where they might nest

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Fig. 14 Male wool carder bee (*Anthidium manicatum*), the only solitary carder bee found in the British Isles. The male establishes and defends its territory around the females' favourite forage plant, *Stachys byzantina*.

and by leaving bumblebee colonies undisturbed. Some of the cavity-nesting solitary bees will often use artificial nests, such as those made of hollow bamboo tubes packed into wooden boxes which you can buy or make – be sure that the tubes are sufficiently long, optimally 15cm, with an internal diameter of 7–8mm.

The red mason bee (*Osmia rufa*) (fig. 13) is a frequent user of artificial nests, but leafcutters (*Megachile* spp.) and the wool-carder bee, *Anthidium manicatum* (fig. 14), may also be attracted.

Many readers will already be doing some or all of these things, and might care to share their experiences on the HPS website. Also, the Trustees of the Society could consider aligning the HPS in some official way with the other associations supporting the National Pollinator Strategy.

As gardeners, it behoves us to play our part in the substantial efforts now being made to halt the decline in pollinators. We can do this by gaining an understanding of the lives and needs of these insects, and keeping them in mind as we plan and manage our gardens.

Tim Riggs

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Plants for Bees, A Guide to the Plants that Benefit the Bees of the British Isles, by W D J Kirk and F N Howes provides valuable information about the main groups of bees and their needs.

Recognition of the plight of pollinating insects, particularly bees, has stimulated a number of research and conservation initiatives:

The Insect Pollinators Initiative (2010) is a £9.5m project involving honeybees, bumblebees and hoverflies, and their role in pollinating cultivated and wild plants. www.lwec.org.uk/activities/insect-pollinators-initiative & www.bbsrc.ac.uk/pollinators

National Pollinator Strategy for bees and other pollinators in England (2014) published by the Department for Environment, Food & Rural Affairs (Defra). It describes collaborative actions between Defra and organisations and individuals across the country to make positive changes that will benefit our pollinators, supporting Defra's *Call for Action, Bees' Needs: Food and a Home.* Gardeners, window-box owners, councils, amenity managers and businesses, are urged to make simple adjustments to existing planting and management to improve the quality and extent of habitats suitable for pollinators. Five simple actions are listed and illustrated in an animated video on the website, www.wildlifetrusts.org/Bees-needs

The BBKA runs *Friends of the Honeybee,* a national fundraising campaign. Members pay a yearly subscription and receive a lapel badge, a packet of seed, a Nectar Gardening Guide, and four issues of the newsletter, *The Pollinator.* The website gives an extensive list by season of garden plants that provide pollen and/or nectar. www.friendsofthehoneybee.com/about

The RHS publishes a list of plants considered to be most attractive to pollinating insects, following an initiative by Sarah Raven. Such plants can be sold with an *RHS Perfect for Pollinators* label and logo. www.rhs.org.uk/science/conservation-biodiversity/wildlife/rhs-plants-for-pollinators