

Botany for Beekeepers: Floral and Extra-floral Nectaries

By Tony Harris NDB, Scottish Expert Beemaster

Where do plants offer their nectar from, how do they let bees know where these nectaries are and how do they tell bees they have already been visited? Tony Harris explains.



Honey bee collecting nectar from borage.

Photo: Tony Harris.



Ant feeding on the extra-floral nectary of wild cherry. Photo: Gerry Collins.

Flowers produce the sweet secretion called nectar, which attracts the bee or other insect and in so doing pollen is transferred between plants. Foragers add their own enzymes, carry it back to the hive, unload it to house bees who deposit the collected nectar into the honeycomb. Surplus water in the nectar is then evaporated by the bees fanning their wings. It is this that becomes honey.

Extra-floral nectaries

We know that bees visit the nectaries of flowers and that in sampling the nectar they often get a dusting of pollen, which is transferred to other flowers, thereby assisting in the pollination of that plant.

Depending on the plant species, nectaries can be found on various parts of a flower, including petals, sepals, stamen and stigmas; these are known as floral nectaries. However, there are other nectaries that can be found on a plant that are not on its flowers; these are known as 'extra-floral nectaries'.

Extra-floral nectaries are thought to serve several purposes. The first is to maintain the balance of water and sugars in the plant. They are also thought to relieve pressure in the phloem by allowing excess sap to be discharged through the nectaries. Another important purpose is to provide the plant with a defence mechanism by attracting insects, such as ants, that will then protect the plant from grazing animals while they feed on the nectar.

Ants also protect plants from insects laying eggs on the foliage, and experiments have shown that plants with ants do better than plants without. In essence, the ants prevent the plant being eaten.

Let us have a look at some examples of plants that have extra-floral nectaries. The broad or field bean, *Vicia faba*, in the Fabaceae family is an excellent source of nectar for bees of several species.

The plant has deep nectaries and only a long-tongued bee, such as the garden bumblebee, *Bombus hortorum*, can reach the nectar from the front of the flower.

Honey bees are used commercially for pollination of the crop but, unfortunately, not in Scotland where I live as it is too cold. To get a decent crop it has to be warm, mid-20°C and the best crops are obtained when the heady aroma is drifting from the fields on the breeze. The honey, which granulates quickly with a coarse grain, varies from light to dark amber in colour and has a pleasant, mild flavour. Field beans also have extra-floral nectaries on the underside of small leaf-like structures called 'stipules' that you can see as a pair of black spots (shown in the photo below). They secrete nectar and are easily accessible by bees, but they also attract ants and aphids.

Cherry laurel, *Prunus laurocerasus*, in the Rosaceae family, is a quick-growing evergreen and the flowers are visited by honey bees and bumblebees in spring. Honey bees also visit when it is not in flower as nectar is secreted from the extra-floral nectaries on the under surfaces of the leaves, particularly on the young growth. The extra-floral nectaries in the



Extra-floral nectaries on leaf stipules of field beans. Photo: Gerry Collins.



Extra-floral nectaries on the underside of cherry laurel. Photo: Adam Leitch

form of a gland beneath a leaf can also be seen here on wild cherry, *Prunus avium*, and, as you can see, honey bees do feed from them.

As well as accessing nectar from extra-floral nectaries, bees can also obtain nectar from holes bitten into the side of flowers thus bypassing the pollination process. Short-tongued bumblebees are unable to reach the nectar hidden deep within comfrey flowers so they will use their strong mandibles to bite into the base of the flower. Honey bees will then come along and feed on the nectar through the 'robbing holes'.



Honey bee feeding on extra-floral nectaries of wild cherry. Photo: Gerry Collins.

Nectar guides

Flowering plants have quite a few tricks up their sleeves to attract pollinators and one of these is the use of nectar guides. These are markings or patterns that guide pollinators to their rewards. They help a bee quickly locate the flower's centre. This adaptation benefits both the flower as it enables more efficient pollination, and the bee for more rapid collection of nectar.



Nectar 'robbing holes' bitten into comfrey. Photo: Adam Leitch.



Honey bee accessing nectar through a 'robbing hole' in comfrey. Photo: Tony Harris.

Some nectar guides are seen as blotches on the lower lip of the corolla, such as on the foxglove, *Digitalis purpurea*, and the pattern clearly leads the bee into the depths of the flower.



Nectar guides on foxglove. Photo: Adam Leitch.

Karl von Frisch did a series of experiments to test bees' perception of colour and we now know that a bee's visual spectrum is different from that of humans; they can see ultraviolet light. This means that some nectar guides within flowers are only visible to bees; we can only see them under a UV light. For example, we see plain yellow petals on the rudbeckia (photo below) but the bees see dark patterns on the petals leading to the centre of the flower where the nectar is.

Plants have all sorts of features and adaptations to assist insects with their vital pollination service. One of these is the use of 'pollinator signals' that tell the visiting insect whether nectar is available or not.



Plain yellow flowers of rudbeckia look different to bees who can see UV wavelengths. Photo: Tony Harris.

Pollinator signals

The forget-me-nots, *Myosotis* species, in the Boraginaceae family, are always popular with bees, including honey bees, and provide a good source of pollen and nectar from April to September. If you look closely at the flowers you will notice that some of the flower centres (known as the



Forget-me-not flowers displaying pollinator signal. Photo: Tony Harris.



Honey bee working white clover, *Trifolium repens*. Photo: Gerry Collins.



The lower petals have been pollinated so they wither and droop. Photo: Gerry Collins.

corona) are yellow and some are white. This is an example of a pollinator signal, as the corona changes from yellow to white when pollinated and this tells the bee not to waste time visiting the flower.

Forget-me-not pollen is said to be 'over represented' in honey due to its tiny size, 3-4 microns, and the very narrow flower tube. The result is that they reach the honey stomach of the honey bee in much greater

quantity than the pollen of other flowers and so find their way into honey easily.

White clover, *Trifolium repens*, in the Fabaceae family, is another excellent source of nectar and pollen for bees and, along with bramble, it forms the bulk of my summer honey crop. It flowers during the main honey flow in summer and produces a light coloured honey of delicate flavour, which is very popular. Like all members of the Fabaceae or bean family it adds nitrogen to the soil, so is used on organic farms as an alternative to fertilisers, but clover meadows are not as common as they once were.

The flower head consists of 50-100 individual flowers that open in a sequence of circles from the outer ring. These florets wither and droop and nectar production ceases once the flower has been pollinated. The flower assists the pollinators by turning its petals brown once it has been pollinated so they do not waste time looking for food.

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Horse chestnut flowers. Photo: Adam Leitch.

Aesculus hippocastanum, in the Sapindaceae family, is a large deciduous tree, commonly known as the horse chestnut or conker tree. The characteristic 'candles' of white flowers, which emerge soon after the leaves, grow up to 20cm tall and are spectacular. Not all the flowers in a spike open at once, so the flowering period is prolonged. Interestingly, once a flower has been pollinated, its colour changes from yellow to red as a signal to visiting bees not to bother with it.

In the final part of this mini-series, next month, I will give you some tips on creating your own bee-friendly garden.

As a member of the National Diploma in Beekeeping (NDB) Short Course Team, Tony teaches a Defra-subsidised two-day course entitled, 'Botany for Beekeepers'.

See the NDB website for more information.

<https://national-diploma-beekeeping.org/>