

## How bees make honey

Honey bees collect nectar and pollen from flowers, but only nectar is used to make honey. Nectar is a "reward" given by the plant to attract bees. Pollen is transported back to the hive in the pollen baskets on the hind legs whereas the nectar is transported in the stomach. Nectar is mostly water with dissolved sugar. The amount of sugar varies greatly but is usually 25-50%. Back in the hive the nectar is placed into wax honeycomb cells and the excess water evaporates until the honey is approximately 83% sugar and 17% water. This takes a few days. The cell is then covered over with a layer of wax which is later removed when the bees need to eat the honey. When large amounts of nectar are being collected the bees speed up evaporation by using their wings to ventilate the hive.



Forager collecting nectar and pollen from borage. The tongue is inserted into the flower's nectary. The pollen basket on the hind leg is part full. Borage is grown in Yorkshire to extract oil from the seed. Some beekeepers move hives close to farms growing borage to make borage honey, which is very pale in colour.

Heather moor in the Derbyshire Peak District. Beekeepers move hives close to heather moors in late July, to take advantage of the August bloom. Heather honey is dark and has a strong flavour. It is unique in being a jelly, not a liquid like most honeys. Britain and Ireland are famous for heather honey.

The sugar is also changed. Sugar in nectar is mostly sucrose (table sugar). Sucrose has large molecules. The bees produce an enzyme which breaks each sucrose molecule into two smaller sugar molecules, glucose and fructose. By evaporating the excess water and converting the sucrose into smaller sugars the bees make the honey too concentrated for yeasts and other microorganisms to grow. Preventing spoilage is important to the bees because the honey made in the summer is used as winter food.

Without at least 10kg of honey a bee colony cannot survive the winter, when there are no flowers.

In addition to sugar, nectar contains other chemicals. Although these are only present in small amounts they are important because they give different honeys their distinctive colours and flavours. Although the bees from one colony collect nectar from many species of plants, at certain times they collect most of their nectar from one or a few species of plants that are very abundant. These "nectar flows" are responsible for most of the honey that actually gets stored. Beekeepers often harvest honey after a nectar flow, thereby producing honey predominantly from a single plant species and with a characteristic flavour and colour.

### Did You Know?

- \* Beekeepers often move their hives to places where there are lots of flowers. The hives are moved by vehicle at night when the bees are all inside.
- \* A full-time bee farmer usually keeps 1000 or more hives. With 30,000 bees per hive that makes 30 million bees to look after.
- \* The bees in a hive help each other to forage more efficiently by telling each other the direction and distance of flower patches using the "waggle dance".
- \* The Quran says this about bees and honey "From its belly comes forth a fluid of many hues, a medicinal drink for men". In other words, honey is good for you!

### How Amazing!

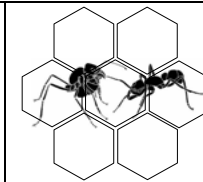
- \* When full, the honey stomach can weigh more than half a forager bee's unladen weight and the forager's abdomen is visibly longer.
- \* It takes approximately 50,000 bee loads of nectar to make one pound of honey.
- \* Honey bees will collect nectar as far as 14km (8 miles) from their hive.
- \* The ancient Egyptians used honey to help wound healing. Modern science has shown that honey kills bacteria and honey is coming back as an antiseptic.

### LASI Research on Honey Making at the University of Sheffield

We study where the bees forage by decoding the waggle dances made by foragers on returning to the hive. They travel up to 14km from Sheffield to heather moors.



The *Laboratory of Apiculture & Social Insects* (LASI), Department of Animal and Plant Sciences, University of Sheffield studies bees, ants and wasps. See our web site for further details. [www.shef.ac.uk/uni/projects/taplab](http://www.shef.ac.uk/uni/projects/taplab)  
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