

I BET YOU DIDN'T KNOW...

What is happening
to the bees

Dr Alison Trew,
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links **cutting edge research**
with the **principles of**
primary science



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Why are scientists interested in bee populations?

All over the world there are reports of declining numbers of bees. Scientists have speculated that this is attributable to microorganisms that can cause disease, climate change, the loss of bee habitats or chemicals used on crops (pesticides). It is important to identify what is affecting bee populations because bees are responsible for helping plants to make fruits and seeds that we need for food.

Why and how do farmers use pesticides?

In agriculture and horticulture, seeds can be coated with fungicides or pesticides to control weeds, insect infestation and diseases. The amount of chemical needed is much less than spraying a crop. Neonicotinoids are insecticides that are widely used as seed coatings and are registered in over 120 countries. Some studies suggest they are harmful to honey bees (Figure 1) and other beneficial insects, but other studies conclude that they are not. In 2018, the European Union banned the use of the three main neonicotinoids, but they are still used in other countries.

Figure 1. European honey bee (*Apis mellifera*)



Why are bees important?

Bees visit flowers to harvest nectar and pollen. As they go from plant to plant, they transfer pollen from one part of the flower to another part (pollination). Plants must be pollinated before they can produce seeds to grow more plants.

Did your last meal include any of these: fruits, vegetables, pulses, rice or bread (which often contains wheat)? Without pollination we could go hungry! Vegetables such as broccoli and cucumber, and fruits such as strawberries, apples and tomatoes, rely on pollination by bees. While there are other methods of pollination, including by the wind, birds, bats, and other insects, wild bees are thought to be the most important pollinators because they pollinate so many plants (a third of the food that we eat is pollinated by bees). Bees also pollinate many of the trees and flowers that provide habitats for wildlife.

What is current research telling us?

For two years, scientists from the UK, Hungary and Germany have worked together to investigate: 1) whether neonicotinoids have a harmful effect on bees; 2) whether the effect of using these chemicals is different between countries. Oil-seed rape was grown in each country with seed coatings containing neonicotinoids (pesticide) or no seed treatment (control). The scientists showed that neonicotinoid exposure reduced honey bee populations in Hungary and the UK, but not in Germany.

How do researchers count bees?

Researchers counted numbers of worker bees during the crop flowering period and in the year after. Primary children could share the experience of surveying insects in their local environment: building a bug hotel is especially good for lacewings and ladybirds; ripe fruit will attract butterflies. You may find other ideas on The Open-Air Laboratories (OPAL) website.

What did the scientists conclude and does the evidence support the scientists' conclusions?

The scientists' conclusions are published in 'Science', a highly respected peer-reviewed journal. They suggest that neonicotinoids have a detrimental effect on bee populations but let us look at their results closely:

- neonicotinoids did not reduce honey bee populations in Germany,
- in the UK, bees' cell numbers were reduced by one type of neonicotinoid but increased by another,
- the control group and two different neonicotinoid treatments also had different fungicide treatments applied with them, so is this a fair comparison.

Some of the data supports the scientists' conclusion but some of the data does not and maybe more work needs to be done.

When scientists are pattern-seeking, how can they know whether one factor that appears to be related to another factor has caused it to happen?

All sorts of things in life are linked (for example, taller people usually have bigger feet) but sometimes we infer relationships that are not there. All of us, including scientists, must be careful about interpreting data when pattern-seeking. A direct relationship (correlation) between two variables does not always mean that one thing has caused the other.

Classes could investigate the difference between coincidental correlations and causal relationships. It might be possible to identify a correlation between two variables that clearly have no impact on each other. For example, children could collect data such as the number of letters in their name, the distance travelled to school, the number of people they live with, their age in months, height or handspan. Using the data to plot scatter graphs, can a direct relationship be identified? Is the correlation causal or coincidental?

Should we be concerned about the bees?

There are around 20,000 species of bee in the world (270 have been recorded in the UK) so you might think that it does not matter too much if a few species of bee become extinct. Certain crops such as blueberries and apples are thought to be >90% dependent on the honeybee pollination in the USA. If the number of these bees decreases, there could be serious consequences for some crops.

There are scientists who believe that conserving honey bees does not help wildlife because the unnaturally high numbers of honey bees managed for agriculture could have a detrimental effect on the numbers of wild pollinators [1]. However, many species of bees visit native flowers to gather pollen and/or nectar and the pollination of plants is simply a by-product of this process. If bee populations decline, this could have a detrimental impact on certain plant populations and the diversity of plants in the natural world. This in turn could reduce animal populations and the diversity of animals and their habitats. Bees are an integral part of most ecosystems. Losing any bee species could have a serious impact on the environment.

Glossary

Pesticide	substance (chemical compounds or biological organisms) that kill pests such as insects, plants, rodents, bacteria, or fungi
Fungicide	substance used to kill parasitic fungi or their spores
Insecticide	substance used to kill insects including their eggs and larvae
Correlation	a statistical measure of how strongly pairs of variables are related

The research paper that generated this work was:

Country-specific effects of nicotinoids pesticides on honey bees and wild bees.

By B. A. Woodcock,¹ J. M. Bullock,¹ R. F. Shore,² M. S. Heard,¹ M. G. Pereira,² J. Redhead,¹ L. Ridding,¹ H. Dean,¹ D. Sleep,² P. Henrys,² J. Peyton,¹ S. Hulmes,¹ L. Hulmes,¹ M. Sárospataki,³ C. Saure,⁴ M. Edwards,⁵ E. Genersch,⁶ S. Knäbe,⁷ R. F. Pywell¹

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Other references:

1. *Conserving honey bees does not help wildlife.* J. Geldmann & J.P. Gonzalez-Varo. *Science* **359**,(6374) 392-393 (2018),

<http://science.sciencemag.org/content/359/6374/392> last accessed 20.4.20