

Friend or Foe:

Establishing the role of *Arsenophonus* in honey bee health

By Georgia Drew, University of Liverpool

*Our bees are exposed to numerous organisms, some of which confer benefits while others are destructive. Georgia Drew is tasked with examining the impact of a bacterium, called *Arsenophonus*, as she explains here.*



Bees foraging and collecting pollen.
Photo by Chris Knott.

The definitive cause of the honey bee decline, and phenomena such as colony collapse disorder (CCD), continue to evade discovery. However, there is a consensus that increased incidence of disease agents is a key contributor. A symbiotic bacterium, *Arsenophonus*, has recently been identified in colonies expressing poor performance. This genus of bacteria is associated with a wide variety of insect hosts, and displays a range of relationships. These interactions can range from parasitic to an insect, right through to mutually beneficial. So far, the majority of work on this bacterium has concentrated on its interactions with the parasitic jewel wasp, in which *Arsenophonus* causes mortality of male eggs. However, as honey bees have such a different lifestyle little can be inferred from these earlier studies about how *Arsenophonus* interacts with honey bees.

***Arsenophonus* is found in smaller, weaker bee colonies**

Previous research at the National Bee Unit, Fera, sampled apiaries of varying health status to find *Arsenophonus* associated with colonies of smaller size and generally poorer health. The project I am working on aims to build on this work and determine the possible causes of reduced health in *Arsenophonus*-infected hives. An association between *Arsenophonus* and bees has been independently noted in a number of other studies and identified in honey bee samples from Israel, Switzerland and America. Thus, *Arsenophonus* effects are not solely confined to the UK. A US study on hives affected by CCD found a greater increase in the presence of *Arsenophonus* than any other bacterium. Thus, potentially, we have a microbe associated with bee colony performance.

Possible reasons for *Arsenophonus* presence

Although the relationship between *Arsenophonus* and honey bees remains

largely unknown, there are three possible scenarios we are likely to encounter. The first is that *Arsenophonus* is pathogenic, and the causative agent of poor health in infected colonies. The second is that *Arsenophonus* only occurs in conjunction with another factor, which reduces health and therefore allows *Arsenophonus* to establish. Finally, *Arsenophonus* could be a protective symbiont of honey bee colonies and thus occurs at high levels in hives of poor health.

Work to be done

This is an incredibly exciting project to be a part of as we look to elucidate the currently unknown role of *Arsenophonus* in hive health. Over the course of the project we will use a combination of approaches, including genome sequencing and infection challenge experiments to explore this relationship. We aim to use the research to construct a plan for improved bee husbandry and look into the development of a potential health screen for hives.

Supervisors and funding

This work is being done at the University of Liverpool, in conjunction with Fera, and is supported by the BBSRC and Bee Diseases Insurance Ltd. The supervisors are Greg Hurst, Alistair Darby (UoL) and Giles Budge (Fera).

*Is *Arsenophonus* a 'good guy' or a 'bad guy'? This research will help us to find out.*