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Highly contagious honey bee virus transmitted by mites

Researchers in Hawaii and the UK report that the parasitic 'Varroa' mite has caused the Deformed Wing Virus (DWV) to proliferate in honey bee colonies. This association is now thought to contribute to the world-wide spread and probable death of millions of honey bee colonies. The current monetary **value of honey bees** as commercial **pollinators** in the **United States** alone is estimated at about \$15-\$20 billion annually

The research conducted in Hawaii by researchers at Sheffield University, the Marine Biological Association, FERA and University of Hawaii, and reported in the journal Science (8 June 2012), showed how Varroa caused DWV – a known viral pathogen – to increase its frequency among honey bee colonies from 10% to 100%. This change was accompanied by a million-fold increase in the number of virus particles infecting each honey bee and a massive reduction in viral strain diversity leading to the emergence of a single 'virulent' DWV strain. As the mite and new virulent strain of virus becomes established across the Hawaiian islands the new emerging landscape will mirror that found across the rest of the world where Varroa is now established.

This ability of a mite to permanently alter the honey bee viral landscape may be a key factor in the recent colony collapse disorder (CCD) and over-wintering colony losses (OCL) as the virulent pathogen strain remains even after the mites are removed.

Ends

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Notes for editors

- Honey bees are the most economically important insects, providing billions of dollars in crop pollination services and valuable hive products.
- Honey bee populations can experience spectacular crashes. The most recent being the well publicized colony collapse disorder (CCD), but its cause remains a mystery.
- During the past 50 years the global spread of the ectoparasitic mite *Varroa destructor* has resulted in the death of millions of honeybee (*Apis mellifera*) colonies. Varroa is a large mite that lives on the surface of honeybees, feeding off their blood and reproducing on their developing brood within the hive.
- The arrival and spread of Varroa across the Hawaiian Islands offered a unique opportunity during 2009 and 2010 to track the evolutionary change in the honey bee virus landscape.
- The mite facilitates the spread of viruses by acting as a viral reservoir and incubator, although four bee viruses often associated with CCD (Kashmir bee, Slow paralysis, Acute bee paralysis and Israeli acute paralysis virus) were not influenced by Varroa in Hawaii.
- One bee virus, the Deformed Wing Virus (DWV), has been implicated in colony losses, for example OCL, as it appears to become ubiquitous wherever Varroa occurs.
- DWV is naturally transmitted between bees via feeding or sex. However, the mites introduce DWV directly into the bee's blood while feeding so creating a new transmission route that bypasses many of the bees' natural defensive barriers.
- DWV is a tiny virus similar to polio or foot and mouth virus and has only 9 genes.
- DWV infected bees may display the classic wing deformity, but the vast majority of infected bees do not show any morphological signs of infection so making it impossible to see the effects of the disease until it is too late.
- In Hawaii the prevalence (frequency) of DWV increased from 6 -13 % in Varroa free areas to 75-100% in areas where Varroa was established.
- The viral load (a measure of the number of viral particles in each bee) increased by a million-fold in areas where Varroa was present. (>1,000,000,000 DWV copies/bee)
- The dominant strain found on Oahu and now Big Island is identical to that found in other areas of the world indicating that the situation on Hawaii is a mirror to what has happened right across the globe.
- Based on comparisons between the 2009 and 2010 samples it appears that changes in viral diversity associated with Varroa are stable and persist even after the parasite levels are reduced via mite treatments.

Contact details

All **honeybee related questions** contact:

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Sheffield University

Sheffield University has recently invested £4m in a new Environment research facility part of which is purposely built for honeybee research. The study of emerging honeybee diseases forms a small part of the Universities 'Project Sunshine' vision that aims to harness the power of the sun to tackle the biggest challenge facing the world today. That is meeting the increasing food and energy needs of the world's population in the context of an uncertain climate and global environment change (<http://www.youtube.com/watch?v=2TcekDGq-WI>). Understanding the changing viral landscape which honeybees and other pollinators operate in will help beekeepers and conservationists worldwide protect these most important insects.

For **virus related questions** contact:

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The Marine Biological Association

The Marine Biological Association (MBA) is a professional body for marine scientists with some 1200 members world-wide. An overarching rationale for our research programme is to understand mechanisms that underlie key marine life processes. This includes research on model organisms (not only marine) that informs our broader knowledge of fundamental processes. The research programme covers a range of disciplines such as virology, cell biology, physiology and functional biology.

Since 1884 the MBA has established itself as a leading marine biological research organization contributing to the work of several Nobel Laureates and over 170 Fellows of the Royal Society.

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