Industry Information Deformed Wing Virus

Article by

Dr Emily Remnant, BEE lab, University of Sydney

14th February 2025

Deformed wing virus has been found in Australia. Should we be worried?

Deformed wing virus (DWV) is a common virus found in honey bee populations across the globe. Despite extensive surveys of honey bee viruses in Australia (1), DWV had not been detected in Australian bees until February 2025, when it was found during re-testing of invasive red dwarf honey bees (Apis florea) which were collected from the Burrup Peninsula in northern WA in 2023. Why was DWV not found earlier? What does this mean for our beekeeping industry, and should we be concerned?

How do we detect exotic viruses?

Virus testing involves combining and crushing a sample of honey bees (for example, 50 workers) from a colony and taking a subsample of this 'bee smoothie' to extract the genetic material. The virus detection step usually involves a technique called PCR, a targeted method that uses specific 'primers' that have been designed to match and amplify a section of the virus genome. This method works when we know the genetic sequence of the virus, however identifying any new viruses requires more in-depth genetic testing.

Some may be wondering why DWV was not detected when red dwarf honey bee colonies were first examined in 2023. There are a few reasons why a virus may not be found during routine surveillance and testing, some of the main ones:

Strength in numbers

Finding an exotic virus at low numbers in a population of bees can be similar to finding a needle in a haystack. Not every bee in a colony will carry the same level of viruses, and unless you test every single bee (which is cost prohibitive), there is a chance a virus may be missed. In addition, some virus levels might be extremely low within an infected bee, making them difficult to detect. Surveillance is a numbers game, it relies on multiple samples across a landscape to ensure an acceptable level of confidence can be achieved. Surveillance should be viewed as an ongoing process rather than a one-off 'yes or no' answer. Any conclusions should be revisited regularly with further sampling - the more you look, the more chance you have of finding things.

It was a case of repeated surveillance showing a positive result in the invasive Apis *florea*. DWV was only detected in one of the 40 colonies tested and it was present at very low levels, and only in the second sample taken from that colony. We can assume that very few workers in that colony were infected, and original testing on the first sample taken from that colony did not include DWV-infected bees, but additional samples from the same colony did.

Viruses mutate quickly!

Each year we need to get a new flu vaccine, which has been designed to specifically protect us against new identified strains that develop. DWV, like influenza, has multiple different strains. The genome of DWV contains 10,000 'letters', called bases. Over time, some bases mutate to generate new versions of the virus which eventually become distinct strains from the original version. The two main DWV strains globally are DWV Strain A (DWV-A) and DWV Strain B (DWV-B), whose genomes contain around 15% of differences in their sequence. Other less common strains also exist (e.g. DWV-C, -D and potentially more).

A targeted PCR method (as described earlier) uses a pair of virus-specific primers, each around 20 bases in length, that can only detect viruses that share this identical sequence. If there is a virus strain that contains a mutation in the part of the genome where the primers should match, they will no longer match, and the test may come up negative. Most of our honey bee virus diagnostic assays are designed so that they target a region of the genome that is common between different strains, or a different test is designed for each of the currently known strains. The tests used for DWV detect *both* major strains with high sensitivity, so it is not the case that the original testing failed to detect DWV when it should have.

What is in our favour?

The DWV detection has been found in a remote area in northern WA, and it has been 2 years since the colony that had DWV was destroyed with no further detections. A quarantine zone around Dampier has been in place since March 2023 and no movement of bees or equipment has occurred since that time. The local environment is harsh and not conducive to rapid honey bee reproduction and the eradication program has continued to destroy any bee colonies as they are found. No managed colonies exist in the quarantine area and few unmanaged European honey bee colonies have been identified, however ongoing surveillance must assess whether any co-localised European honey bees are at risk of coming into contact with any remaining red dwarf bees in this region, as DWV can be transmitted by bee-to-bee contact when foraging on resources or robbing.

Importantly, DWV has been confirmed in only one red dwarf honey bee colony, and **all** of the 40 other colonies have tested negative for DWV after two rounds of testing. This is encouraging, but virus testing of any additional red dwarf honey bee colonies, and any European Honey Bees found in the area is needed before we know whether DWV has established in the invasive population or not.

What happens now?

On its own, DWV rarely causes disease symptoms in bees. When combined with varroa, DWV is spread rapidly and virus infections in bees are much more deadly. The red dwarf honey bee detection in northern WA has its own mite called *Euvarroa*, but it is not known to spread DWV in the same way, nor is it known that the *Euvarroa* mites carried by our invasive Apis *florea* will be able parasitise our managed honey bees (2).

Now that DWV has been detected in the West, and with varroa establishing in the East, if the virus and mite meet, it will create an association where mites can now spread and amplify the DWV infection in our managed hives. Adhering to movement restrictions in the red dwarf honey bee quarantine zone is critical.

All efforts to avoid uniting DWV with European honey bees, and especially bees with Varroa *destructor*, should be a priority. We know from overseas that once DWV emerges in a varroa-affected bee population, mite management becomes even more challenging.

Dr Emily Remnant, BEE lab, University of Sydney;

With thanks to Danny Le Feuvre, Dr Cooper Schouten, Dr Nadine Chapman and Dr John Roberts for contributions, discussion and feedback.

References

1. Roberts, J. M. K., D. L. Anderson and P. A. Durr (2017). "Absence of deformed wing virus and Varroa destructor in Australia provides unique perspectives on honeybee viral landscapes and colony losses." Scientific Reports 7(1): 6925.
2. Ramsey, S. D. (2021). "Foreign Pests as Potential Threats to North American Apiculture: Tropilaelaps mercedesae, Euvarroa spp, Vespa mandarinia, and Vespa velutina." Veterinary Clinics: Food Animal Practice 37(3): 545-558.