

Pathogenic plant virus jumps to honeybees

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Honeybee. Credit: Adam Siegel

A viral pathogen that typically infects plants has been found in honeybees and could help explain their decline. Researchers working in the U.S. and Beijing, China report their findings in *mBio*, the online open-access journal of the American Society for Microbiology.

The [routine screening](#) of bees for frequent and rare [viruses](#) "resulted in the serendipitous detection of Tobacco Ringspot Virus, or TRSV, and prompted an investigation into whether this plant-infecting virus could also cause [systemic infection](#) in the bees," says Yan Ping Chen from the U.S. Department of Agriculture's Agricultural Research Service (ARS) laboratory in Beltsville, Maryland, an author on the study.

"The results of our study provide the first evidence that honeybees exposed to virus-contaminated pollen can also be infected and that the infection becomes widespread in their bodies," says lead author Ji Lian Li, at the Chinese Academy of Agricultural Science in Beijing.

"We already know that honeybees, *Apis mellifera*, can transmit TRSV when they move from flower to flower, likely spreading the virus from one plant to another," Chen adds.

Notably, about 5% of known plant viruses are pollen-transmitted and thus potential sources of host-jumping viruses. RNA viruses tend to be particularly dangerous because they lack the 3'-5' proofreading function which edits out errors in replicated genomes. As a result, viruses such as TRSV generate a flood of variant copies with differing infective properties.

One consequence of such high replication rates are populations of RNA viruses thought to exist as "quasispecies," clouds of genetically related variants that appear to work together to determine the pathology of their hosts. These sources of genetic diversity, coupled with large population sizes, further facilitate the adaption of RNA viruses to new selective conditions such as those imposed by novel hosts. "Thus, RNA viruses are a likely source of emerging and reemerging infectious diseases," explain these researchers.

Toxic viral cocktails appear to have a strong link with honey bee Colony Collapse Disorder (CCD), a mysterious malady that abruptly wiped out entire hives across the United States and was first reported in 2006. Israel Acute Paralysis Virus (IAPV), Acute Bee Paralysis Virus (ABPV), Chronic Paralysis Virus (CPV), Kashmir Bee Virus (KBV), Deformed Wing Bee Virus (DWW), Black Queen Cell Virus (BQCV) and Sacbrood Virus (SBV) are other known causes of honeybee viral disease.

When these researchers investigated bee colonies classified as "strong" or "weak," TRSV and other viruses were more common in the weak colonies than they were in the strong ones. Bee populations with high levels of multiple viral infections began failing in late fall and perished before February, these researchers report. In contrast, those in colonies with fewer viral assaults survived the entire cold winter months.

TRSV was also detected inside the bodies of Varroa mites, a "vampire" parasite that transmits viruses between bees while feeding on their blood. However, unlike [honeybees](#), the mite-associated TRSV was restricted to their gastric cecum indicating that the mites likely facilitate the horizontal spread of TRSV within the hive without becoming diseased themselves. The fact that infected queens lay infected eggs convinced these scientists that TRSV could also be transmitted vertically from the queen mother to her offspring.

"The increasing prevalence of TRSV in conjunction with other bee viruses is associated with a gradual decline of host populations and supports the view that viral infections have a significant negative impact on colony survival," these researchers conclude. Thus, they call for increased surveillance of potential host-jumping events as an integrated part of insect pollinator management programs.

Provided by American Society for Microbiology

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