Simpler method for measuring viral infections in bees

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It can be difficult to evaluate how serious a virus infection in a bee colony is. A new tool from the Department of Agroecology makes it easier. Credit: Colourbox

Scientists from Aarhus University have developed a model that makes it

easier for beekeepers to assess the seriousness of viral infections in their honey bees.

Do you need to sound the alarm if there are 100,000 virus particles in the beehives - or is there nothing to be worried about until there are 10 million? It may be difficult for most people to juggle such large numbers, but now scientists from Aarhus University have made it easier for beekeepers to conclude on how serious the pressure of viral infections in their bee colonies is.

On the basis of observations in Danish bee colonies, the scientists have grouped the incidence of viral infections into four categories. This means that instead of using a sliding scale of numbers with a whole lot of zeros behind it, you can just refer to the four categories. This makes it easier for the beekeepers, when, for example they need to decide on whether to take preventative action or not and on whether a bee colony can be used for further breeding. It is also an important tool for scientists.

"When you have to fight epidemics it is important to know how widespread the disease and what its cause is. This also applies to the prevalence of viruses in honey bees. With our method it is simpler to evaluate this prevalence," says Senior Scientist Per Kryger from the Department of Agroecology at Aarhus University.

Bees are essential

Honey bees are important players in our food chain. They help to ensure that crops are pollinated so that flowers turn into fruit. In recent years, honey bees have experienced problems on a worldwide scale: bee colonies have collapsed for unknown reasons. Since 2006, about 30 percent of the honey bee colonies are lost every year in the USA. While the situation in Denmark is not quite as serious, it is still a problem that

colonies collapse without knowing the exact cause.

Several factors may be to blame, either alone or in unison, including viruses, parasites and various forms of stress. Honey bees resistant to the varroa mite and to the microscopic, sponge-like parasite Nosema apis have successfully been bred. Maybe the same could be done in the battle against viruses.

Previous studies have shown that the virus is prevalent in many bee colonies and that only very few honey bee colonies are completely free of virus. This also applies to apparently healthy colonies, so a kind of tolerance must have developed that means the bees do not get sick even when they are infected.

This fact implies that it may be possible to grow resistant colonies. Selective breeding requires, however, that you can count the number of virus particles so that the right colonies can be selected to produce the next generation.

Honey bee colonies under the microscope

To get an idea of the current infection level in Denmark, the scientists examined healthy Danish honey bee colonies for seven different viruses. They also examined colonies from apiaries with a high incidence of the varroa mite or a high mortality rate in winter.

"We looked at the infection level of Danish bees with a focus on healthy bee colonies. The results can form the reference level for assessments of the health of a bee colony," says Esmaeil Amiri, who carried out this project as part of his PhD studies at Aarhus University with the help of numerous Danish beekeepers who sent healthy bees to the study.

It turned out that there was a large difference in the occurrence of the

virus in diseased and healthy colonies. Of the healthy colonies, 36 percent contained no viruses at all. In the sick colonies, there was at least one type of virus in each colony. There was also a large variation in the number of virus particles in both groups, and it was common to see several types of virus simultaneously in the same colony. The most commonly occurring virus was the Sacbrook virus (SBV), the Black Queen Cell Virus (BQCV) and the Deformed Wing Virus (DWV).

Based on their observations, the scientists drew up four categories of infection level:

- Free (0 virus particles)
- Low (more than 0 but less than 1,000 virus particles)
- Intermediate (greater than or equal to 1,000 but less than 10,000,000 virus particles)
- High (more than or equal to 10,000,000 viral particles)

Classification of the viral number into four categories enabled the scientists to statistically compare the virus levels in diseased and healthy bee colonies. This classification benefits not only scientists.

"When beekeepers can work with four categories of virus numbers instead of a sliding scale, it makes it easier for them to make strategic decisions in order to prevent further spread of the disease or in in the breeding work," says Per Kryger and continues:

"It is important that the knowledge we generate can be understood by laymen. We believe that this simplified data set is a means towards this end."

More information: Read the scientific article "Four categories of viral infection describe the health status of honey bee colonies" which has been published in *Plos One*: www.ncbi.nlm.nih.gov/pubmed/26448627

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