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The role of innate immunity for virus tolerance in the Gotland honeybee population

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Background and Purpose
Pathogens lead to numerous pressures on the health of honeybees (Apis mellifera) worldwide. Honeybees, being social insects, have a complex immune system to cope with pathogens, with both innate immunity at the individual level and social immunity at the colony level. The honeybee population from the island of Gotland, Sweden, are well-known for their independent resistance to Varroa destructor mite infestation and tolerance to virus infections, in particular Deformed Wing Virus (DWV) and Acute Bee Paralysis Virus (ABPV). However, the immune mechanisms underlying the virus tolerance in this population are still unclear. The purpose of this study was to investigate the innate immunity of Gotland honeybees towards virus infections to determine possible genetic variation of the expression of different immune genes.

Methodology
Adult honeybees from the Gotland population and a local mite-susceptible population were collected at series of time points following an oral inoculation of virus infections to detect the function of innate immunity in the competition between honeybees and viruses. Several genes related to the production of antimicrobial peptides along with the genes involved in RNA interference pathways were tested in these bees using qRT-PCR. The differential expression of genes from ABPV orally inoculated adults from sugar feed adults as a control group, was analyzed.

Results and conclusions
The Gotland honeybees survived the oral virus inoculation better than the susceptible honeybees in this study. We found that the expression of immunity-related genes changes over time and changes differently between populations. The biggest differentiation gene expression between the Gotland population and the susceptible population appeared at 24h after viral inoculation. However, some genes did not show difference between populations at all. More results will be discussed.

Practical implications for beekeepers
Comprehensively investigating honeybee innate immune strategies, and their relative importance for bee health, will benefit disease tolerance breeding efforts to safeguard honeybees and the important pollination services they provide for our well-being.