Honey bees fight back against Varroa

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BioMed Central's open access journal *Genome Biology* finds that specific proteins, released by damaged larvae and in the antennae of adult honey bees, can drive hygienic behavior of the adults and promote the removal of infected larvae from the hive. Credit: Queenie Chan

The parasitic mite *Varroa destructor* is a major contributor to the recent mysterious death of honey bee (*Apis mellifera*) colonies. New research published in BioMed Central's open access journal *Genome Biology* finds that specific proteins, released by damaged larvae and in the antennae of adult honey bees, can drive hygienic behavior of the adults and promote the removal of infected larvae from the hive.

V. destructor sucks the blood (hemolymph) of larval and adult bees leaving them weakened and reducing the ability of their immune systems to fight off infections. Not that honey bees have strong immune systems in the first place since they have fewer immunity genes than solitary insects such as flies and moths. These tiny mites can also spread viral disease between hosts. This double onslaught is thought to be a significant contributor to Colony Collapse Disorder (CCD).

But all is not lost - honey bees have evolved a way to fight back: hygienic behavior where diseased or parasitized larvae are removed from their brood cells, and Varroa-sensitive hygienic behavior which they use to reduce the number of reproductive mites on remaining larvae.

To find exactly how bees respond to hive infections, researchers from Canada looked at the natural behavioral of bees in the presence of damaged larvae and compared this to protein differences in the larvae and adults. After scanning 1200 proteins the team found that several proteins, including LOC552009 (of unknown function but similar to ApoO), found in the antennae of adults were associated with both uncapping brood cells and the removal of larvae. Other proteins were involved in olfaction or in signal transduction, probably helping the adults find infected larvae amongst a brood.

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In damaged larvae, transglutaminase, a protein involved in blood clotting, was upregulated, which appeared to be a key component in regulating the adult's behavior. Other proteins indicated adaptations to help fight infection, including chitin

biosynthesis and immune responses.

Dr Leonard Foster from CHIBI at the University of British Columbia, who led this research said, "Bee keepers have previously focused on selecting bees with traits such as enhanced honey production, gentleness and winter survival. We have found a set of proteins which could be used to select colonies on their ability to resist Varroa mite infestation and can be used to find individuals with increased hygienic behavior. Given the increasing resistance of Varroa to available drugs this would provide a natural way of ensuring honey farming and potentially survival of the species."

More information: Correlation of proteome-wide changes with social immunity behaviors provides insight into resistance to the parasitic mite, Varroa destructor, in the honey bee Apis mellifera Robert Parker, M Marta Guarna, Andony P Melathopoulos, Kyung-Mee Moon, Rick White, Elizabeth Huxter, Stephen F Pernal and Leonard J Foster *Genome Biology* (in press)

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