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Recognition of mite-infested brood by honeybee (*Apis mellifera*) workers may involve thermal sensing

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Abstract

Hygienic behavior, i.e. the removal of diseased or damaged brood by worker honey bees (*Apis mellifera*), is seen as one of the principal behavioral elements of this species' social immunity. Identification of the stimuli that trigger it would be helpful in searching for biochemical and molecular markers of this important breeding trait. While many studies at the genomic, transcriptomic, and behavioral level have pointed to the implication of chemical cues, we here hypothesized that thermal cues are alternatively/additionally involved. To test this hypothesis, we first measured whether infestation by the mite *Varroa destructor* (a condition known to induce hygienic behavior) leads to a thermal gradient between affected and unaffected brood. We found that infested brood cells were between 0.03 and 0.19 °C warmer than uninfested controls. Next, we tested whether artificially heating an area of a brood comb would increase the removal of infested or uninfested brood as compared to an unheated control area, and found that this was not the case. Finally, we investigated whether the heating of individual brood cells, as opposed to comb areas, would influence brood removal from cells adjacent to the heated one. This was the case for uninfested, though not for infested cells. We conclude that infestation by V. destructor leads to a heating of brood cells that should be perceivable by bees, and that small-scale temperature gradients can influence brood removal. This makes it appear possible that thermal cues play a role in triggering hygienic behavior of honey bees directed at varroa-infested larvae/pupae, although our results are insufficient to prove such an involvement.

Keywords: Varroa destructor; uncapping; thermography; gradient sensing

1. Introduction

The ectoparasitic mite *Varroa destructor* is seen as the most important pest of the Western honey bee (*Apis mellifera*) in both economic and ecological terms (Le Conte et al., 2007; Le Conte et al.,