



# Effects of *Varroa destructor* on temperature and humidity conditions and expression of energy metabolism genes in infested honeybee colonies

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**ABSTRACT.** *Varroa destructor* mites pose an increasing global threat to the apicultural industry and agricultural ecology; however, the issue of whether certain environmental factors reflect the level of mite infection is far from resolved. Here, a wireless sensor network (WSN) system was used to examine how *V. destructor*, which has vital impacts on honeybee (*Apis mellifera*) health and survival, affects the temperature and humidity of honeybee hives in a field experiment. This approach may facilitate early identification of *V. destructor* in hives, and thus enable timely remedial action. Using quantitative PCR, we also evaluated the expression of two genes, adipokinetic hormone (AKH)

and adipokinetic hormone receptor (AKHR). The results showed that temperature in highly infested broods was higher than that in broods with low infestation. Moreover, mite infection in honeybee colonies was positively correlated with temperature but negatively correlated with humidity ( $P < 0.05$ ). Similar to previous observations, quantitative analysis suggested that the expression levels of AKH and AKHR from honeybees with low infection were significantly higher than those from bees with high infection ( $P < 0.01$ ). These results showed that the expression levels of these genes in colonies with high mite infestation were closely associated with changes in hive temperature and humidity. This study demonstrates that *Varroa* infection not only causes changes in temperature inside honeybee colonies, but also affects the expression of honeybee energy metabolism genes.

**Key words:** *Varroa destructor*; Temperature; Differential expression; Energy metabolism