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Chemo-whispering: A possible adaptive trait of honey bees to reduce varroa mite reproduction

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ABSTRACT
Background and Purpose
Some honey bee (Apis mellifera) populations can survive varroa mite infestation with minimal to no treatment. These populations exhibit reduced varroa reproductive success, but the mechanisms behind this remain unclear and may vary between populations around the world. This is the case for the well-studied mite-resistant honey bee population of Gotland in Sweden. The purpose of this study was to better understand host-parasite interactions between honey bees and varroa mites, focusing on how the mites reproduction may be disrupted.

Methodology
To begin we compared the reproductive success of the varroa mite exposed to adult bees, which could remove mites, versus those caged without adult bees having access. Since adult bee presence did not affect the mite reproductive success, we investigated pupal characteristics that might inhibit mite reproduction. Specifically, we examined brood pheromones (specifically fatty acid methyl and ethyl esters and (E)-beta-ocimene) released by the pupae during the early capping period (0-36 hours), when mite reproduction is triggered in both resistant and non-resistant brood. Gas chromatography was used to analyze these pheromones.

Results and conclusions
We found that varroa-resistant honey bee pupae produced lower levels of specific pheromones compared to varroa-susceptible ones. These pheromones are typically used to communicate information, such as developmental stage, from the pupae to adult worker bees, but are also intercepted by varroa mites to locate suitable hosts for feeding and synchronize reproduction. Our study suggests that varroa-resistant honey bees employ a type of chemical camouflage, which we have termed “chemo-whispering”, where the bees produce lower pheromones levels that prevent varroa mites from recognizing host signals, thus mite reproduction.

Practical implications for beekeepers
This research provides valuable insight into developing better bee health management strategies concerning varroa infestation and offering potential for more sustainable beekeeping practices.