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ABSTRACT BOOK

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BEE HEALTH

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OP-160 [Bee Health]
Remote detection and monitoring of invasive species of hornets (Vespa velutina and Vespa mandarinia) using acoustic tools

Huw Evans, George Clouston
Beehero Inc

Beekeeping in Europe has faced significant challenges from Vespa velutina since its introduction in France in 2004, with the species now widespread across the continent. Similarly, the arrival of Vespa mandarinia (Asian Giant Hornet) in 2019 and V. velutina in 2024 threaten North American beekeeping. These invasive wasps prey on honey bees and other pollinators, potentially causing ecological, economic, and public health impacts if established. The ability to detect their presence as well as monitor their spread is fundamental to any measures aimed at eradication or control. This paper describes how acoustic based tools were used to remotely detect the unique flight signature of V. velutina and V. mandarinia. Over the past 8 years, working in apiaries across Europe, a device was trained for the detection of V. velutina near beehives, sending alerts to beekeepers. The equipment was tested in a number of environments including the apiaries hosting V. crabro, a protected species of honey bee predator.

Following the introduction of V. mandarinia into Washington state, working in collaboration with the USDA the device was used to monitor the entrance of an established V. mandarinia nest. This generated large quantities of high-resolution audio recordings of V. madarinia flight activity; these recordings were used to produce robust detection algorithms. From the data we were able to profile the daily nest activity, such as as commencement and cessation of daily flight and overall traffic, which correlated well with the nest's population and manual observation. The differences in acoustic signatures of hornets of known sizes and weights, constrained within a flight tent, were extrapolated to profile the nest demographic. The system has since been adopted by the department of agriculture in Georgia (US) for used on mainland and remote islands following the introduction of V. velutina.

Practical application of this technology provides early detection of hornet presence in apiaries and potential entry points, while tracking activity at established sites. Additionally, it could inform longer term strategies for eradication and containment, by improving knowledge of hornets' behaviour while identifying areas of activity, better define how and where resources should be focused for maximum effect.

OP-161 [Bee Health]
Assessing pesticide impact on honeybee gut microbiota: a call for microbial diversity as an environmental risk assessment endpoint

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A recent roadmap for integrating environmental microbiota into risk assessments under the European Food Safety Authority (EFSA) remit has been published. The honeybee gut microbiota has emerged as a promising avenue to protect bees against stressors. Honeybees exhibit a stable core microbiota, and dysbiosis may serve as an indicator of adverse conditions.

We investigated the gut microbiota of newly emerged "Apis mellifera iberiensis" workers exposed to a single concentration of the insecticide flupyradifurone (FPF, 36 ppm). The control groups included pure syrup (negative control, NC) and syrup supplemented with 1% acetone (acetone control, AC). Laboratory trials followed official guidelines (OECD No. 245). The abdomen of each bee was separated from the thorax, and DNA extraction was performed individually. Full-length 16s rRNA amplicon metagenomic was sequenced through PacBio sequel II (HiFi/CCS mode).

The Shannon diversity index was used to analyze honeybee gut microbiota composition across experimental groups. Our results revealed a significant increase in bacterial community diversity (Shannon index, $P = 0.003$) after ten days of chronic exposure to FPF. This effect was more pronounced when compared to the AC group ($P = 0.003$) than to the NC group ($P = 0.03$). These findings demonstrate that FPF disrupts the honeybee gut microbiota.
This study represents the first characterization of honeybee gut microbiota strictly adhering to OECD guidelines without modifications or adaptations. Furthermore, we have provided new insights into pesticide risk assessment, highlighting an overlooked aspect of bee health assessment. We propose integrating this approach into pesticide risk assessments by using diversity indices as comparative parameters. Specifically, we advocate for the inclusion of honeybee gut microbiota dysbiosis as a sublethal effect in the initial screening phase of risk assessments (laboratory-based assays) and as a key parameter for evaluating pollinator health.