PP-156 [Bee Health]
The expanding threat of Vespa orientalis: insights from Malta on microbiota, pathogens, and beekeeper perceptions

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Vespa orientalis, the Oriental hornet, is increasingly recognised as an emerging invasive threat worldwide, with populations expanding beyond its native range into Europe, South America, and beyond. While considered indigenous to Malta, its growing numbers and intensifying impact on beekeeping mirror those of an invasive species. This study combines microbiota and pathogen analysis with a three-year beekeeper survey (2022–2024) to assess V. orientalis's potential as a pathogen reservoir, and the associated risks to beekeeping.

Despite growing reports of V. orientalis predation on honey bees, its gut microbiota and potential to harbour pathogens remain understudied. Additionally, beekeeper surveys tracking hornet sightings, colony losses, intervention effectiveness, and response strategies provide valuable insight into its perceived and actual impact on apiaries.

This study analysed the gut microbiota and pathogen presence in V. orientalis specimens from four locations in Malta, comparing individuals that fed on honey bees and those that scavenged on cat food. 16S rRNA gene sequencing and qPCR were used to assess microbial diversity and detect bee pathogens presentin the hornet. In parallel, beekeeper survey responses were evaluated to track changes in hornet sightings, colony losses, and mitigation strategies.

Microbial analysis revealed a core gut microbiota dominated by Firmicutes and Proteobacteria, with diet-based differences. Arsenophonus, a genus linked to honey bee-associated bacteria, was enriched in hornets preying on honey bees, suggesting potential microbial exchange between hornets and bees. Pathogen screening identified Nosema ceranae and Crithidia bombi, both known to impact pollinators.

Survey analysis highlighted fluctuating but persistent impacts of V. orientalis. Colony losses dropped in 2023 but rose again in 2024, despite more beekeepers taking action. Intervention effectiveness also declined in 2024, with more beekeepers reporting that control measures were ineffective. Findings indicate that V. orientalis's impact on beekeeping persists and may be worsening as mitigation efforts decline in effectiveness.

With traditional control measures becoming less effective, new management strategies are urgently needed. Integrating scientific research with beekeeper-driven surveillance will be key to long-term mitigation both in Malta and globally. Additionally, insights into V. orientalis gut may open new avenues for biological control, offering targeted microbial-based strategies to regulate hornet populations.