## PP-032 [Bee Health]
## Natural antibacterial solutions: essential oils and hydrolates for beehive health

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Beekeeping environments, where thousands of honeybees coexist in confined spaces, are prone to microbial infections. Some honeybee-associated bacteria, like Bacillus larvae, Melisococcus plutonius, Streptococcus apis, Pseudomonas, and Salmonella paratyphi are pathogenic, while others, such as Lactococcusspp., provide beneficial effects. Varroa destructor mites, infecting honeybees, further spread harmful microbes like Erwinia, Enterococcus, Stenotrophomonas, and Bacillus. Plants and their substances can affect the survival of microorganisms that are common in honeybee environments. Plant-based essential oils (EOs) can influence microbial growth, either inhibiting or stimulating bacteria depending on the type, dosage and target organism. This study aims to identify essential oils and hydrolates that inhibit pathogens without harming beneficial bacteria.

Molecular methods, including PCR, restriction analysis, and sequencing, were used to identify bacteria on honeycombs and bee larvae. Seven genera were detected: Bacillus, Pseudomonas, Moraxella, Priestia, Micrococcus, Hafnia, and Staphylococcus. Moraxella sp. and Micrococcus sp. were most common on honeybee larvae, while Bacillus spp. dominated honeycombs. Seven bacterial strains were selected for testing with EOs and hydrolates: B. subtilis, P. aeruginosa, Streptococcus pyogenes, Moraxella osloensis, Staphylococcus warneri, Lactobacillus brevis and L. plantarum. Eleven EOs were used, including mint, oregano, lemon balm, lemon tea tree, various thyme chemotypes, lemongrass, linden flower, and carrot seed. Disk diffusion and evaporation tests showed that oregano, lemongrass, lemon balm, thyme-mint blend, and all thyme EOs had the strongest antimicrobial effects. Lemon balm EO was unique in inhibiting potential pathogenic bacteria but not beneficial Lactobacillus spp. Seven hydrolates were selected for antimicrobial analysis: aniseed lofant, lemongrass, wormwood, medicinal chamomile, lavender, and calendula. Lavender hydrolate had the strongest antibacterial properties, while medicinal chamomile was the weakest. No hydrolate selectively inhibited pathogens while not affect Lactobacillus.

The identification of microorganisms in the honeybee environment is important to know the microbiological status and susceptibility to disease. Natural plant-based substances possessing antimicrobial properties may help to maintain hive health. Among essential oils tested, lemon balm shows promise for pathogenic bacteria control, but further research is needed on their interaction with beeswax and honeybee response. This study was funded by the Research Council of Lithuania (project no. S-MIP-24-55).