Breakthroughs in Honey Bee Health: Continuous-Release Mist Diffusion of Thymol-Based Essential Oils

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Honey bee (Apis mellifera) pollination is responsible for approximately 80% of all cultivated crops. Unfortunately, the latest reports suggest losses of 30-50% of all bee colonies in the US. The greatest single contributor to the decline of bee health is the Varroa destructor mite. Synthetic chemicals are currently used to control Varroa, but the mites are developing resistance. Essential oils (EOs) may be a viable alternative. EOs are cheaper, environmentally-friendly, and pose fewer health risks to bees and consumers. Furthermore, Varroa have not developed resistance to EOs. EOs' shortcoming is the limitation of exposure. Humidity and temperature affect the rate of evaporation and the mites' exposure to EOs. This study evaluated the "continuous-release" mist diffusion of thymol-based EOs against Varroa. Essential oils from the thymol family were found to be effective against Varroa without causing harm to honey bees. Miticide activity was as follows: thyme > oregano > rosemary > spearmint > control (vegetable glycerin). Honey bee mortality in the tested EOs was comparable to the control. Mist diffusers provided continuous-release of EOs, eliminating fluctuations in temperature and relative humidity. Continuous-release mist diffusion with EOs was more cost-effective than commercially available thymol-based systems ($3.20/application versus $15-$18/application). Presently, all commercially available thymol-centered systems are gel-based and only work via direct contact with the mite. "Continuous-release" mist diffusion may permit the disbursement of EOs throughout the entire hive, including the brood cell, where natural miticides currently do not reach and where Varroa reproduction occurs.

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