



Continuous-Release Mist Diffusion of Thymol-Based Essential Oils for *Varroa* Control: The Field Study

ABSTRACT

Honey bee (*Apis mellifera*) pollination is responsible for approximately 80% of all cultivated crops. Unfortunately, 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* mite. Synthetic chemicals are currently used to control *Varroa*, but the mites are developing resistance. Essential oils may be a viable alternative. Essential oils are cheaper, environmentally-friendly, pose fewer health risks to bees and consumers, and most importantly *Varroa* have not developed resistance to essential oils. Its' shortcoming is the limitation of exposure. Humidity and temperature affect the rate of evaporation and therefore the mites' exposure to essential oils. Currently, all commercially available thymol-centered systems are gel-based and work only by direct contact with the mite. Following the laboratory investigation (Part I), a field study (Part II) examined the use of thymol-based essential oils, dispersed via battery-operated mist diffusers, to provide effective miticide efficacy without causing harm to honey bees in the hive environment. The use of the mist diffusers effectively eliminated fluctuations in temperature and humidity. Miticide efficacy was recorded as follows: thyme>oregano>rosemary > control (glycerin). Across all tested essential oils, the highest miticide activity occurred during the first two weeks of treatment. The safety of the tested essential oils to honey bees was found to be comparable to the vegetable glycerin control. Furthermore, a brief cost analysis demonstrates the use of mist diffusers was more cost-effective than commercially available thymol-based systems (US\$3.20 versus US\$15-\$18 per application). Continuous-release mist diffusion permits the disbursement of essential oils throughout the entire hive and effectively provided early elimination of mites as they emerged from the brood cell, while remaining safe for honey bees.