Control of Varroa destructor Infestation with a Dual-Function, Thymol-Emitting Honey Bee Hive Entranceway

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In the last decade, one-third of all honey-bee colonies have vanished, in Colony Collapse Disorder (CCD). The root cause of CCD has been debated, with focus on pesticides, and varroa mite (vm) infestation of hives. Recent literature provides evidence that vm feed on fat bodies of honey-bees, which when depleted, weakens the honey-bee so that pesticides can cause death. Therefore, a simple and effective method to remove vm from hives is urgently needed, and is the focus of this research. To begin, a beehive entranceway was designed, that released thymol “miticide” onto the bees upon contact, as they enter/leave the hive. The entranceway is dual-function, also time-releasing gaseous thymol into the hive. A 20x20x150mm entranceway, with 13 alternating 9mm circular holes, was 3D-printed and coated with a 50/50-%w/w mixture of thymol/Hydromed-D in ethanol. The entranceway was placed onto a bee-hive, where bees demonstrated indifference to the entranceway. Under normal bee-behavior, GC-FID analysis of bee-body highlights as much as 28µg of thymol released onto the bee by contact-per-day. With a demonstrated 4-day exponential decay, the vm LC50 for thymol (56µg) is reached only four days after entranceway installation. Similar analysis of the 4L headspace for a (19.75’’x16’’x20’’) hive revealed 5.44µg/L of thymol released, acting as ongoing vm control throughout the hive. Entranceway release of thymol surpasses that of the most widely-used thymol varroacide, and is temperature-independent throughout the practical range of use (2°C-45°C). Finally, GC-FID modeling suggests a 1-month lifetime of the entranceway, which is easily recharged without disturbing the hive.

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