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PP-015 [Bee Health]

LACTIC ACID TREATMENT WORKS THROUGH A LOCAL WAY OF ACTION AGAINST *VARROA DESTRUCTOR*

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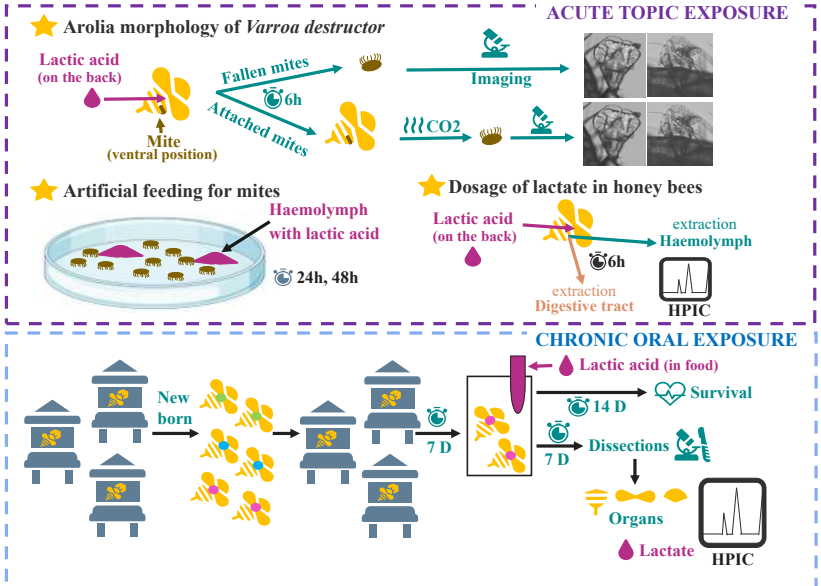
Introduction

Lactic acid is an alternative treatment to hard chemicals against *Varroa destructor*, the parasitic mite of the Western honey bee *Apis mellifera*. This soft acaricide is used only for small apiaries due to its laborious administration [1]. However, the mode of action of this honey bee medication remains unknown. We investigated the nature of lactic acid activity in the hive treatment context: local or systemic. A local way of action indicates that the effects of the treatment does occur at the site of contact, in this case the honey bee cuticle, whereas a systemic way of action indicates that the effects of the treatment occur at a location distant from the point of contact.

In addition, the off-target effects of such medication should not be overlooked either as many acaricides are known to impact honey bees health [2]. Therefore, we investigated the effect of contaminated with field-relevant concentrations of lactic acid on honey bees and measured the lactate in their organs or haemolymph. Studies focusing on the mode of action of alternative treatments are of prime interest and could give rise to new opportunities for control strategies against *V. destructor*.

Materials & Methods



Results

ACUTE TOPIC EXPOSURE

Arolia morphology of *Varroa destructor*

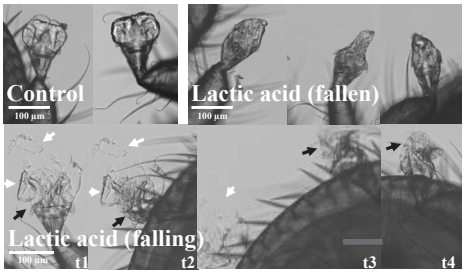


Figure 1. Effects of lactic acid (150 mg/mL) on *V. destructor* arolia during the first six hours after the treatment of honey bees. (Control) Arolia with a normal cushion-like shape from control parasites. (Fallen) Altered arolia from fallen mites before six hours. (Falling) Kinetics showing that the fluid is drained from the arolium. *White: fluid; Black: arolium*

Artificial feeding for mites

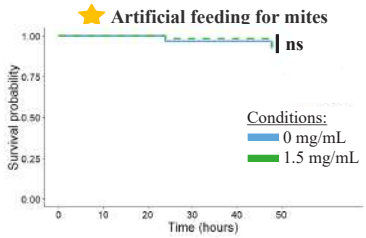


Figure 2. Survival rate of *V. destructor* when fed on lactic acid contaminated diet was not different between control or treated mites (N=30 mites/concentration).

Dosage of lactate in honey bees

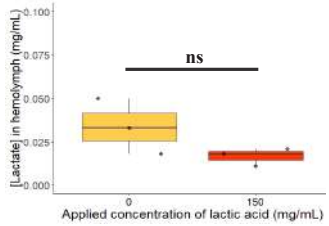


Figure 3. Lactate concentration in honey bee haemolymph 6h after topical exposure of lactic acid at 150 mg/mL. Each dot represents a hive (N=30 bees/concentration).

CHRONIC ORAL EXPOSURE

Dosage of lactate in honey bees

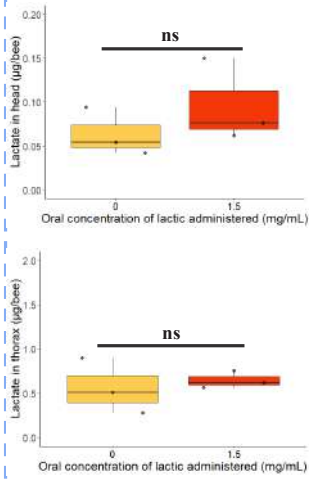


Figure 4. Lactate concentration in honey bee heads and thorax after chronic oral exposure of lactic acid at 1.5 mg/mL. Each dot represents a hive (N=15 honey bees/ [C])

Conclusions & Perspectives

- Mite arolia are altered after bee topical treatment (150 mg/mL).
- Contaminated haemolymph with lactic acid does not affect mite survival.
- No significant accumulation on lactate in bees organs after a chronic oral exposure of field-relevant residual concentration of lactic acid (1.5 mg/mL).
- Lactic acid activity presents consistency with a local mode of action against *V. destructor*.
- Future perspectives : Assessing the combined effects of topic and oral exposure on honey bees health.

Sources: [1] Kraus, B. & Berg, S. Effect of a lactic acid treatment during winter in temperate climate upon *Varroa jacobsoni* Oud. and the bee (*Apis mellifera* L.) colony. *Experimental and Applied Acarology* 18, nº 8 (1994): 459-68.

[2] Benito-Murcia, M et al. Evaluating the Chronic Effect of Two Varroacides Using Multiple Biomarkers and an Integrated Biological Response Index. *Environmental Toxicology and Pharmacology* 94 (2022): 103920.

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PP-015 [Bee Health]
Lactic acid treatment works through a local way of action against Varroa destructor

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Lactic acid is an alternative treatment to hard chemicals against Varroa destructor, the parasitic mite of the Western honey bee Apis mellifera. This soft acaricide is used only for small apiaries due to its laborious administration. However, the mode of action of this honey bee medication remains unknown, especially in a realistic in-hive scenario, i.e. after an indirect exposure of the mite through honey bees. We investigated the nature of lactic acid activity in the hive treatment context. The local and/or systemic way of action of this honey bee treatment against V. destructor was studied through a toxicological approach at the individual level. On one hand, we showed the altered morphology for the arolia of mites, affecting their grip skills, and studied the evolution of the process over time. On the other hand, we found that haemolymph contaminated with lactic acid did not kill the feeding parasitic mite. In addition, the off-target effects of such medication should not be overlooked either as many acaricides are known to impact honey bees. Therefore, honey bees workers were fed on diets contaminated with field-relevant concentrations of lactic acid and did not show an increase of lactate in their organs or haemolymph. These findings support a local mode of action and provide a new comprehension of lactic acid activity against the parasitic mite through honey bee exposure. Studies focusing on the mode of action of alternative treatments are of prime interest and could give rise to new opportunities for control strategies against V. destructor.