

# Effect of systemic administration of essential oils and main components on honeybee survival

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## MATERIALS AND METHODS

Oils were obtained by hydrodistillation from *Laurus nobilis*, *Cinnamomun zeylanicum*, *Origanum vulgare*, *Rosmarinus officinalis* and *Eucalyptus spp.* and were analyzed by gas chromatography.

The main components (M.C.) administered were 1,8-cineol,  $\beta$ -myrcene, cinnamic aldehyde, carvacrol and  $\alpha$ -phellandrene. Substances were administered *ad libitum* to newly emerged bees at concentrations of 0; 333; 3,333 and 6,666 ppm, on sucrose syrup, throughout 11-18 days.

Mortality and substances consumption were measured daily. Survival analysis was performed using Gehan-Breslow test and pairwise multiple comparisons between survival curves ( $\alpha = 0,05$ ).

Substances consumption was analyzed using one way ANOVA.



*L. nobilis*



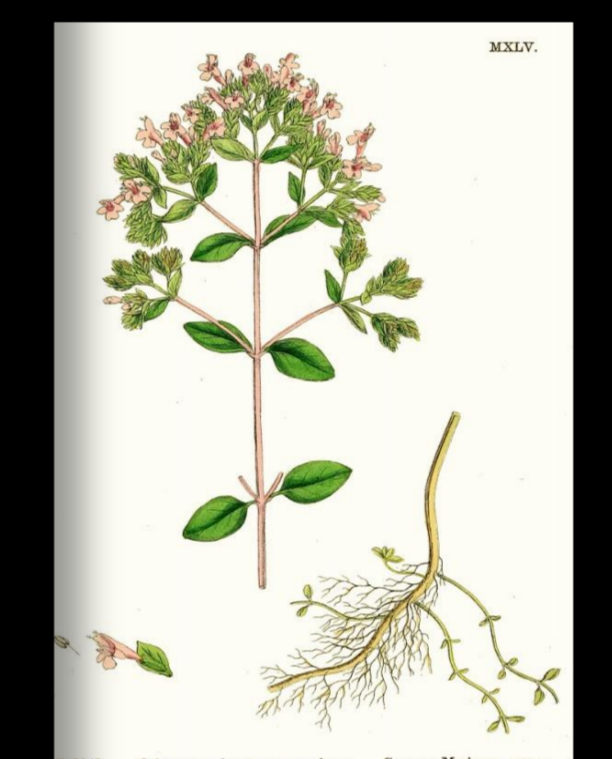
*Eucalyptus sp.*



*R. officinalis*



*C. zeylanicum*



*O. vulgare*

Controlling bee diseases with non contaminant products is a challenge in apicultural research.

Essential oils and their main components have been widely studied as alternative treatments for honeybee pathologies.

However, there is little information about prolonged systemic administration.

The aim of this study was to evaluate, in laboratory assays, the effect of long term consumption of essential oils and main components on honeybee lifespan and consumption.

## RESULTS

Bees that received cinnamon oil showed a lower survival than control at concentrations higher than 333 ppm ( $p$ -values  $< 0.001$ ). Consumption of cinnamic aldehyde, the main component of this oil (79.3%), also caused lower survival at the same concentrations ( $p$ -values  $< 0.001$ ). Eucalyptus oil caused a lower survival rate when it was administered at 6,666 ppm, although 1,8 cineol, its main component (63.5%), was not toxic for bees at any concentration. Carvacrol, a main component of many oregano essential oils, showed toxic effects at 3,333 and 6,666 ppm.

Essential oils did not cause differences in consumption rate ( $p = 0.275$ ) while main components solutions, except for carvacrol, were less consumed than control at the three concentrations. Treatments did not cause dysentery to bees.

## DISCUSION / CONCLUSION

Our results contribute to understanding the effect of repeated systemic doses of these substances, which is important to design long term pharmacological studies and treatments development.

Essential oils and M.C. are commonly classified as harmless, toxic or benign for systemic administration. However, the toxicity produced by a substance may cause sublethal effects. Also, harmless or benign effects may change over time or under interaction with the proteic food (beebread) and microorganisms in the colony and bee luminal medium. Therefore, further experiments under field conditions are needed.

