

# Detecting the nutritional state of honey bee colonies

**By starving honey bee colonies, the CRC for Honey Bee Products has identified important biochemical pathways in honey bee nutrition that show the significance of proteins and lipids in their diet.**

Honey bee nutrition is important for complete colony health during the larval development of honey bees. The healthy nutritional condition of managed honey bees is essential for the provision of pollination services and the optimal productivity of honey.

**As natural habitats for hive sites decline, beekeepers face challenges in maintaining nutrition for their managed honey bees.**

In a changing environment, beekeepers seek alternatives to natural sources (flowers) of honey bee food. Nutrition experiments investigating new bee food formulations are time-consuming and require complicated field trials.

Finding chemical marker indicators of health or malnutrition would assist in nutrition assessment accuracy and knowledge-building. Understanding the honey bee nutrition demand at a molecular level will help find solutions.



**CRC HBP**  
FOR HONEY BEE PRODUCTS



bee health



biomarkers



food resources



CRC PhD student, Clarisa Castaños, weighs hives under nutritional treatments and during the recovery period with CRC beekeeper, Tiffane Bates





CRC researchers compared colonies exposed to three different diets: starvation, sugar feeding and pollen feeding in an environment with no nectar or pollen resources for five weeks. Regular measurements of hive weight, brood coverage, temperature and humidity, together with the weekly collection of newly emerged worker bees and their analysis, uncovered the nutritional differences at a biochemical level.

The research showed that newly emerged bees responded to the lack of resources during their larval development by using fatty acids from fat reserves and amino acids catabolised from proteins to meet their energy demand.

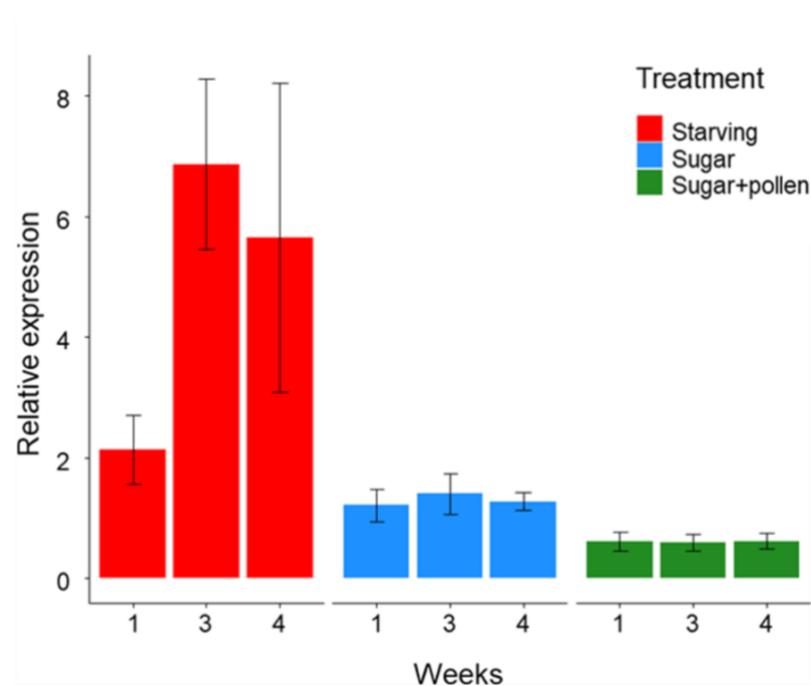
**CRC researchers identified three biomarkers that could be used to provide early signs of colony malnutrition and allow a quick response by beekeepers.**

Three desaturase enzymes were pinpointed as involved in the mobilisation of fat reserves during malnutrition. These offer the opportunity to develop a refined laboratory test that detects the early onset of colony malnutrition by rapidly measuring a few bees, allowing beekeepers to take action to recover colony health at an early stage of malnutrition.

CRC research has highlighted the changes in metabolism in developing bees under starvation. Beekeepers can use this knowledge for the identification of critical flora, or to develop supplementary diet formulations to improve colony health when adequate pollen is unavailable or insufficient.

This knowledge can also be used to study the effects of artificial formulation supplements on honey bee diets.

Nutrition biomarker tools identified by the CRC for Honey Bee Products will support Australian beekeepers safeguard colony health for continued pollination services to sustain Australia's food security.



Relative expression of desaturase enzymes over time under the different treatments. Desaturase is expressed strongly during starvation, allowing malnutrition to be identified early.