Unravelling the secrets of producing bioactive honey

CRC for Honey Bee products researchers determined when and how Manuka bioactive honey is formed by tracking dihydroxyacetone (DHA) appearance in nectar throughout the lifecycle of *Leptospermum* flowers.

Manuka honey is famous for its bioactive properties, which are derived from the compound methylglyoxal. For methylglyoxal to form, nectar harvested by honey bees must first contain a specific ingredient, dihydroxyacetone (DHA). As the honey matures, DHA converts into the bioactive methylglyoxal. DHA naturally occurs in the nectar of some Leptospermum species, but it is not typically a plant metabolite. As DHA is critical to the development of this form of bioactive honey, it is important to understand where, when and how DHA is produced.

CRC researchers investigated the timing when DHA appears during a flower's lifecycle and used gene transcript patterns to propose a pathway to explain its appearance in the nectar.

Researchers collected nectar across the lifecycle of flowers from wild and cultivated *L. polygalifolium*, a species endemic to Queensland and NSW, and wild *L. nitens* from Western Australia. Flower nectar from both species contained high levels of DHA and typical nectar sugars, as confirmed using High Performance Liquid Chromatography analysis.

CRC PhD student Sylvester Obeng-Darko showing Dan Dixon *Leptospermum scoparium* flower stages to predict nectar and DHA production

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bioactive honey

genetic diversity

chemical analysis

In both *Leptospermum* species, the appearance of DHA in the nectar followed the sugar profile. The DHA and total sugar concentrations peaked early in flower development and then declined as the flowers aged. The timing of peak DHA appearance was earlier in *L. nitens* than in *L. polygalifolium*.

Nectary tissue underlying the surface of *L. nitens* flowers was collected at different stages of flower development, and a full complement of messenger RNA sequences was recovered. Unravelling these sequences will help understand the enzymes involved in the production of DHA and how the regulation of these pathways behaves as the flowers age.

This research enables growers and apiarists to predict and optimise DHA levels in nectar to increase methylglyoxal levels, therefore increasing the bioactive nature of their mature Manuka honey.

Apiarists now know the best flower stage for bees to forage on *L. polygalifolium* and *L. nitens* to optimise the harvest of DHA.

While not part of the original investigation, CRC researchers found that other species of Myrtaceae outside of the genus *Leptospermum* also accumulate DHA in their nectar.

Both *Ericomyrtus serpyllifolia* and *Verticordia chrysantha*, species endemic to Western Australia, were found to accumulate DHA in their nectar. This provides exciting opportunities for Western Australian apiarists to produce bioactive honey from other endemic species.

CRC PhD student Sylvester Obeng-Darko collects nectar from flowers for analysis

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