

Hon-E-Vite Active Serum & Australian Native *Melaleuca Alternifolia* Honey

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Executive Summary

Jenbrook Pty Ltd harvests certified organic tea tree (*Melaleuca alternifolia*) extracts from plantations situated in the Bungawalbin Valley region of Northern NSW, adjacent to the pristine Bungawalbin Nature Reserve. Due to the high abundance of native Australian flora and the vast availability of organically grown tea tree, Jenbrook Pty Ltd in collaboration with Eve Investment have developed a range of honey products through the joint venture, Meluka Honey Pty Ltd. They aim to produce four major honey based products, which include three tea tree and Australian native based raw honey products.

Tea tree has a long history of ethnobotanical use by the Bundjalung people of New South Wales, where crushed leaves were applied topically to wounds and a leaf infused tea was brewed for oral anti-septic activity [1]. Tea tree oil has been investigated for a range of bioactive properties including anti-bacterial, anti-fungal, anti-viral, anti-protozoal and anti-inflammatory activity [1]. Tea tree oil has been used in Australia since the 1920s and has an expanding use due to the low dermal irritancy when applied at lower than 100% concentrations and efficacy in a number of clinical and non-clinical settings [2]. The anti-microbial activity of the aqueous constituents of tea tree is also being explored to determine the effects on European honeybee hives, where tea tree is to be incorporated into the honeybee diet to suppress bacterial growth from opportunistic bacteria (fouling), improve gut function, and as a potential anti-microbial for pathogenic bacteria.

The scope of this study is to report on the anti-oxidant bioactivity and chemical properties of tea tree honey for topical uses and consumption. The effect of tea tree on experimental hives will also be reported, including some of the chemical transformations that occur *in vivo* within the honeybee digestive tract and the effect of tea tree on the honeybee gut microbiome. The final products are in a late formulation stage and this report aims to inform improvements in product formulation, production, handling, storage and transport.

Project Conclusion

Meluka honey shows strong immediate anti-oxidant and sustained anti-microbial activity which is coming directly from the natural bioactive properties of tea tree (*Melaleuca alternifolia*) in combination with the properties of multifloral honey. Therefore, Meluka honey doesn't require a lengthy period of chemical ripening to reach its maximum bioactive value - unlike Manuka, which requires the slow chemical ripening of dihydroxyacetone (DHA) to methylglyoxal (MGO). MGO forms in honey post-harvest, so there may be lower benefit to bees in the production of Manuka versus Meluka, particularly when only mono-floral resources are provided to bees to produce MGO rich honey. All bees benefit from a mixed diet, where pollen provides essential nutrients responsible for metabolism, immune function, reproduction and the cuticular layer coating (barrier function and water loss). Nutritional deficiencies in one plant species can be supplemented by foraging on other available species, so reducing pollination availability to one plant species in the production of a bioactive honey may reduce bee health. Meluka resolves this, by incorporating bioactive tea tree into the bee diet, whilst still allowing pollen and nectar to be gathered across a wide range of native Australian plant species.

Tea tree within the bee's diet appears to act as a probiotic, increasing the proportion of beneficial bacteria - family Neisseriaceae, which contains the species *Snodgrassella alvi*, is responsible for gut immune function. Tea tree supplementation also had no effect on the family Orbaceae, including species *Gilliamella apicola*, which helps in the metabolism of difficult to digest plant constituents. The use of tea tree as a bee supplement does not limit diverse foraging for honey production, so bees are able to gather mixed pollen and nectar which improves bee health in addition to the gut-microbiome effect of tea tree. Inclusions of up to 10% in the diet did not affect gut microbial load and was well tolerated by hives across short intensive feeding periods and at a six months post feeding.

Overall, Meluka has shown to be a multi-bioactive honey that has immediate activity not reliant on post-harvest ripening. The production of Meluka also has a mutual benefit to bees, where supplementation with tea tree acts as a probiotic for increases in detoxifying bacteria in the *Neisseriaceae* family.

