Leatherwood Honey

Descriptors and Bioactivity

CRCHBP
FOR HONEY BEE PRODUCTS

LEATHERWOOD HONEY

Terroir [1]

Eucryphia lucida trees produce a prolific show of white blossoms, and to attract flower visitors, secrete copious amounts of nectar from the base of the flower which the honey bees thrive on to make Leatherwood honey. This rare species is endemic to Tasmania – confined to the wild, temperate rainforest regions. The trees flower late in the summer for a month each year. So, in the dying days of summer the honey bees produce an ochre-yellow, golden-coloured honey.

Production

Only skilled beekeepers can manage their honey bees to keep abreast with the Leatherwood nectar production. To be organised for this short flowering window, it takes a year of planning and preparation. The healthier the hive, the greater the nectar harvest ripening into honey in the super hive box.

Flavour

Leatherwood honey is distinctive. Sommeliers define the flavour as clean and fresh with notes of balsamic and a lightly spicy finish – a perfect accompaniment on a cheese platter or combined in sauces to accompany seasonal vegetables. When Leatherwood flavour is measured using an e-tongue, compared to other honeys, it is distinct, having high umami and a pleasant bitterness that continues into the aftertaste.

Health

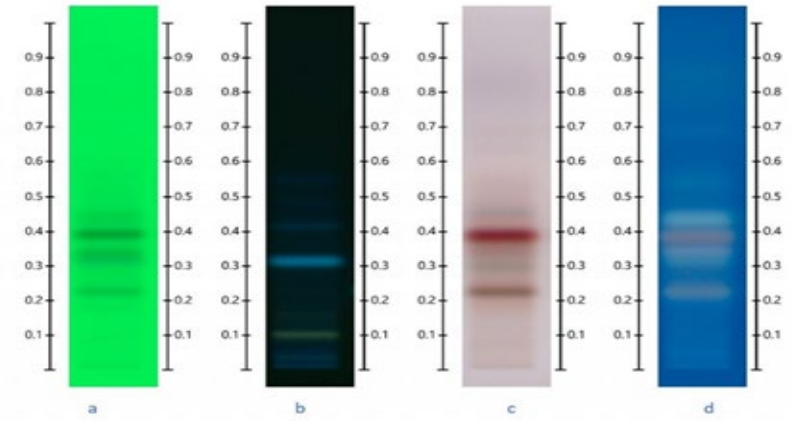
Honey is the only naturally (honey bee) produced and harvested sweet product on our shop shelves. Because of this, honey can capture the natural bioactivity of the flower's nectar as utilised by the bee hive for its health maintenance. All honey is antibacterial, but in Leatherwood honey there is additional bioactivity related to peroxide enzyme activity and additional superoxide scavenging abilities related to the high phenolic content.

[1] Photographs are examples

Honesty

As *Eucryphia lucida* flowering is dominant and attractive to honey bees, Leatherwood honey is a monofloral honey and can be easily confirmed using a High Performance Thin Layer Chromatography analysis[2]. The distinct signature is :

- 254 nm – one black band at RF 0.4
- 366 nm – two distinct bands at RF 0.32 (Bright blue) and RF 0.1 (yellow)
- White light derivatised – two characteristic bands at RF 0.4 (red) and RF 0.23 (dark brown) with a minor organce band underneath
- 366 nm after derivatisation – four distinct bands at RF 0.3 (blue-green) RF 0.35 (beige) RF 0.38 (light brown) RF 0.45 (light blue)



Physical characteristics

Parameter	range	
pH range (neutral is 7)	4.5 to 6.0	mean 5.0
Electrical conductivity	374 to 824	mean 541
Colour	0.21 to 1.19	mean 0.39 absorbance units
Moisture (must be lower than 21%)	14.9 to 18.0	mean 15.8 %

Terroir

Eucryphia lucida Labill. (Eucryphiaceae), is endemic to Tasmania and grows in the temperate rainforests at sub-alpine to low altitudes and thrives in a cool to warm, wet environment. It a tall tree and produces prolific white blossoms of 2 – 3 cm diameters, which have a high nectar flow for 4 – 6 weeks in late summer producing best when between 100 and 150 years of age[3]. It provides viability to the Tasmanian honey industry as the consistency and volume of nectar flow is awesome.

[2] Locher, C., J. Neumann and T. Sostaric (2017). "Authentication of honeys of different floral origins via high-performance thin-layer chromatographic fingerprinting." JPC - Journal of Planar Chromatography - Modern TLC Journal of Planar Chromatography 30(1): 57-62.
[3] Mallick, S. A. (2000). "Technique for washing nectar from the flowers of Tasmanian leatherwood (*Eucryphia lucida* Eucryphiaceae)." Austral Ecology 25: 210–212.

Flavour profile

Leatherwood honey has an ochre-yellow colour and the flavour is clean and fresh with notes of balsamic and a lightly spicy finish. The unique flavour is reminiscent of the pristine forests on which they rely. The singular taste derived from Leatherwood can be distinguished by objective analyses undertaken on electronic detectors which show the distinctive volatile profile contains high levels of 2,6-dimethyl-3,7octadiene-2,6-diol, vanillin methyl ether, hotrienol and lilac aldehyde isomers which contribute to the characteristic flavour and aroma. Hotrienol confers a distinctive sweet, tropical, fennel and ginger bouquet in Leatherwood honey which has further complexity due to floral notes from lilac aldehydes, the woody earthy and flower aroma of orivone and the woody, caramel and cherry odour and taste of sweet creamy vanillin due to levels of vetraldehyde. It can be clearly distinguished from mixed blossom honeys and other monoflorals, having a significantly higher umami (mouth-feel), richness and sweetness.

Health

Leatherwood is a bioactive honey having antibacterial activity that is in addition to the osmolarity (high sugar content), low moisture and pH common to all honeys. The high levels of hydrogen peroxide activity in the Tasmanian honey, which ranged from 5.7 to 35.2 µg per gram with a mean value of 21.2 ± 8.4 µg per gram of honey, is further enhanced by phenolics and flavonoids. When tested against four microbes[4], Leatherwood honeys had Antibacterial Activity Values (AAVs) ranging from 300 to 550 with 78% recording AAVs higher than 300. Effective activity is set at above 300 to 500 whilst 550 to 600 (phenol equivalence of 30.1 ± 5.1) is regarded as very high activity. AAVs of 250/300 are consider low activity with generic multifloral honey having a AAV of only 150.

Antibacterial measurements

Parameter	range	
Peroxide activity	6 to 35 µg/g	mean 21.2 ± 8.4 µg
Total Activity (AAVs)	300 to 500	mean 414

The bioactivity of Leatherwood honey is due to the peroxide activity and phenolic compounds. This is completely different from the bioactivity of Manuka honey which is attributed to the presence of methyl glyoxal (MGO). It has been reported that MGO and hydrogen peroxide do not occur in honey together as MGO has been shown to inhibit the enzyme, glucose oxidase, which is responsible for the production of hydrogen peroxide. The peroxide activity of Leatherwood honey makes it particularly suitable for application on dry wounds or to treat dermatological conditions.

Components that contribute to the bioactivity of Leatherwood honey include methyl syringate which is present at levels of 0.3ppm to 38ppm. Methyl syringate is a strong superoxide scavenger which inhibits inflammatory cascades[5]. 3-Phenyllactic acid, which has been shown to inhibit the growth of *Aspergillus fumigants* and *Penicillium roqueforti* was also detected in 83% of Leatherwood honey screened in this study and was found at levels as high as 124 ppm (mean 6ppm) corroborating the range of 52-92ppm reported[6]. 4-Hydroxy benzoic acid was present in all Leatherwood honeys

[4] Green, K. J., K. Dods and K. A. Hammer (2020). "Development and validation of a new microplate assay that utilises optical density to quantify the antibacterial activity of honeys including Jarrah, Marri and Manuka." PLOS ONE 15(12): e0243246.
[5] Stephens, J. M., R. C. Schlothauer, B. D. Morris, D. Yang, L. Fearnley, D. R. Greenwood and K. M. Loomes (2010). "Phenolic compounds and methylglyoxal in some New Zealand manuka and kanuka honeys." Food Chemistry 120(1): 78-86.
[6] Meloncelli, D. M. (2019). "Authentication of Australian and New Zealand honey origins by chromatography, and their anti-inflammatory properties." PhD thesis, University of the Sunshine Coast.

alongside p-anisic acid (0.3 to 3.8 ppm, mean 0.9ppm). Leatherwood honey also contains tricetin, pinobanksin, luteolin, pinocembrin, and chrysin and the combined mean levels of flavonoids and phenolics were 901.2 and 2066.6 ppm respectively[7]. Quantification of the known flavonoids and phenolic acids in Leatherwood honey indicate that gallic acid, chlorogenic acid, caffeic acid, p-coumaric acid, quercetin and chrysin are also present at trace levels. These bioactives all contribute to the average level of 40mg of total phenolic detected in each gram of Leatherwood honey with darker honeys having higher levels which correlated with higher antioxidant capacity.

Antioxidant measurements

Parameter	range	
DPPH	<10.5 to 95	mean 51.6 µmol/100g AAE
FRAP Fe2+ eq.	123 to 592 µm/100g	mean 272 µmol/100g
Total Phenolics	22 to 65 mg/g GAE	mean 40 mg/g GAE

Leatherwood honey was shown to be 73% sugars with fructose to glucose levels of 41 and 31% respectively. Contrary to popular perception, not all monosaccharides elicit the same blood sugar levels in humans such that the Glycaemic Index (GI) for sugars and honeys vary. For example, fructose has little effect on glycaemia. The GI of commercial blended honey is reported to be 87 compared to Australian blended honeys which have a moderate GI of 58 (moderate GI=56-69, high >70, glucose =100) [8]The GI of five Australian monofloral honeys were reported to range from 40 to 49 (levels below 55 are regarded as low GI). The differences in the GI recorded between the floral varieties of honey warrants the establishment of the GI of Leatherwood honey which beyond the scope of this project.

All honey can be used as sweeteners for cakes and breads because they retain moisture compared to table sugar (sucrose)[9] but some honeys further benefit consumers being prebiotic and have been clinically tested and listed as therapeutic by the Therapeutic Goods Administration (TGA). Prebiotics stimulates the proliferation of beneficial gut bacteria. counteracting harmful bacteria that are associated with obesity, colon cancer, gastric ulcers and functional bowel diseases [10] [11]. With the establishment of a prebiotic index (PI) as measured in a simulated intestinal microcosm[10], Leatherwood honey was shown to have a PI of 240, compared to 50 for sucrose, and was the third most effective out of 18 Australian monoflorol honeys tested in promoting the proliferations of 4 major prebiotics. The microbial profiles from such trials are consistent with those observed to be associated with health benefits in human clinical studies. These finding suggests that healthier confectionary could be developed by replacing sugar with Leatherwood honey.

[7] D'Arcy, B. R. (2005). Antioxidants in Australian Floral Honeys. R. I. R. a. D. corporation: 84.
[8] Arcot, J. and J. Brand Miller (2005). A preliminary assessment of the Glycemic index of honey : a report for the Rural Industries Research and Development Corporation. Barton, A.C.T, Rural Industries Research and Development Corporation.
[9] D'Arcy, B., N. Caffin, B. Bhandari, N. Squires, P. Fedorow and D. Mackay (1999). Australian liquid honey in commercial bakery products, RIRDC publication. No 99/145.
[10] Conway, P. L., R. Stern and L. Tran (2010). The Value-adding Potential of Prebiotic Components of Australian Honey, Rural Industries Research and Development Corporation.
[11] Vyas, U. and N. Ranganathan (2012). "Probiotics, prebiotics, and synbiotics: gut and beyond." Gastroenterol Res Pract 2012: 872716.

Similarly, Leatherwood honey can function as a natural preservative for meat products, yoghurt, bakery or salad dressings due to the antioxidant effect of phenolic acids and flavonoids[9] which combined with low pH, high osmolarity and low moisture provides an unsuitable environment for most bacteria. The preservative qualities are supplemented with the infusion of the flavours and aroma unique to Leatherwood.

In the cosmetic industry, the high sugar concentration of honeys makes it hygroscopic and antibacterial with moisturising properties. It has a soothing effect on skin and hair[12]. The moisturising properties can be ascribed to glucose and fructose which can trap moisture of the skin layer through hydrogen bond formation[13]. Other constituents like proline and gluconic acid contribute. The by-product of the enzymatic conversion of glucose to produce hydrogen peroxide by glucose oxidase are likely to increase the level of gluconic acid in Leatherwood honey.

Storage

Leatherwood honeys stored at 4 ˚C away from light remained stable at room temperature and it is best stored in an amber container in the fridge.

[12] Burlando, B. and L. Cornara (2013). "Honey in dermatology and skin care: a review." Journal of Cosmetic Dermatology 12: 306-313.
[13] Jimenez, M. M. (1994). "The galenic behaviour of a dermopharmaceutical excipient containing honey." International Journal of Cosmetic Science 16(5): 211-226.

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