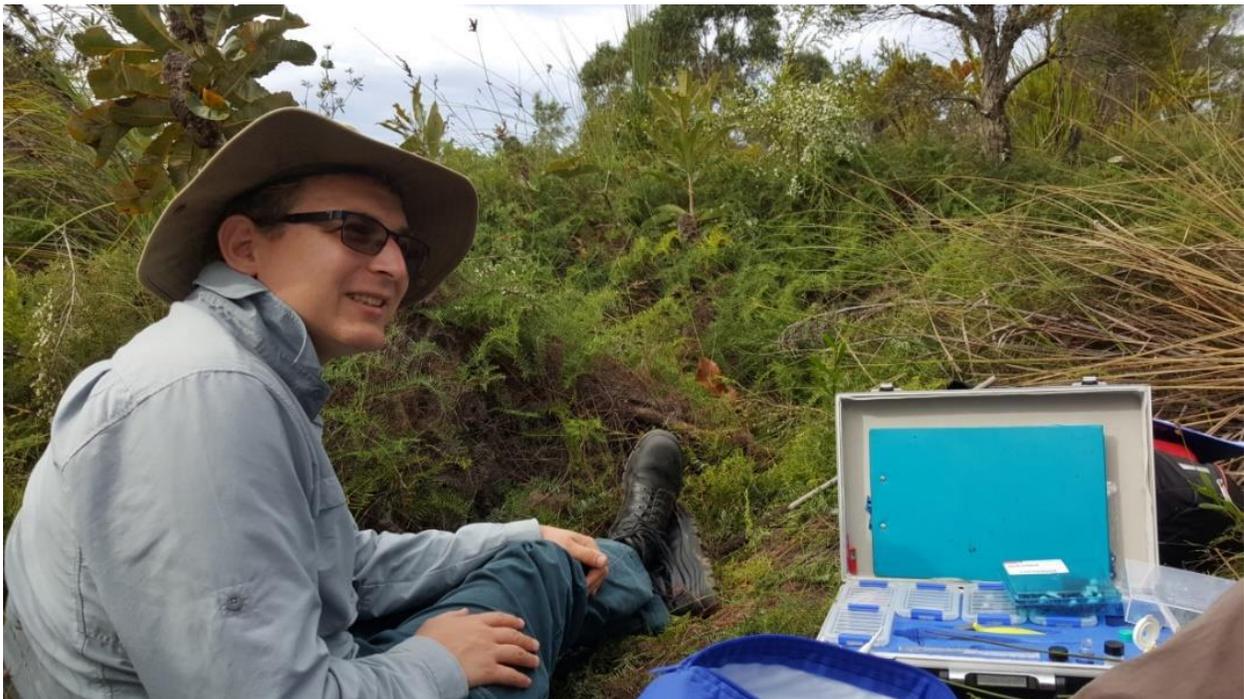


Australian medicinal *Leptospermum* Honeys

A talk given to for the South Gippsland Landcare Network's Manuka Honey and *Leptospermum* in Gippsland field day held at Bell Park Scout Camp on Sunday January 15th 2017 by

Simon Williams

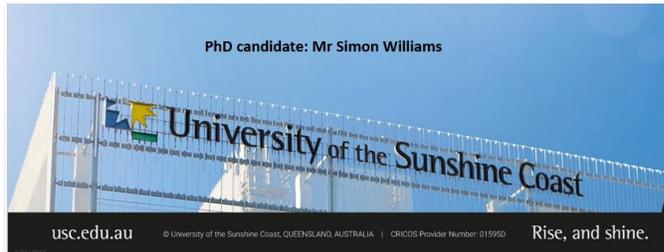
PhD candidate with the University of the Sunshine Coast.



Demonstrating Sustainable Farm Practices is supported by the South Gippsland Landcare Network, through funding from the Australian Government's National Landcare Programme and PPWCMA



Australian medicinal *Leptospermum* Honeys, Chemistry and New Sources



New Sources & Bioactivity of Australian *Leptospermum* Honeys

University of Sunshine Coast

- chemical tests (honey & nectar)
- fieldwork

University of Technology Sydney

- collection of honey and plant samples
- bioactivity tests
- sending results to beekeepers

University of Sydney

- antifungal tests

www.rirdc.gov.au/honeybee-pollination

Why the interest in medicinal honey?

Used as a medicine throughout history of human race

- wound dressing
- significant antimicrobial (germ-killing) activity
- fell from favour in 1940s antibiotics discovered

Antimicrobial activity of honey

- High sugar content (~80%)
- Acidity (low pH)

- Hydrogen peroxide
 - from bee enzyme
 - e.g. jarrah, spotted gum
- Floral factors
 - **non-peroxide activity (NPA)**

Similar in most honeys

Varies greatly in different honeys

- e.g. *Leptospermum* (manuka/jellybush) honey

Most honeys have a high sugar content giving them a high osmotic pressure. This makes honey water absorbing. This reduces the available water for microbes to grow while providing a moist environment for wound healing. Honey generally also has a low pH which is not ideal for microbial growth. Most Honeys have some degree of Hydrogen peroxide activity due to an enzyme bees add. This can vary depending on the honey. Jarrah and Leatherwood honeys can have high Hydrogen peroxide activity. Honeys also have what we call floral factors characteristics caused by the trees the nectar comes from. *Leptospermum* honeys have this in the form of Non-peroxide activity.

‘Ratings’ used on medicinal honey

Total activity (TA or Active+)

- all activity → hydrogen peroxide + and any non-peroxide activity
- “bioactivity”

Non-peroxide activity (NPA) and Unique Manuka Factor (UMF®)

- unique to *Leptospermum* honeys (manuka or jellybush) from NZ and Aus
- NPA and UMF® are equivalent, but UMF® = trademark registered in NZ
- both measured using bioactivity test

Methylglyoxal (MGO or MG)

- chemical test
- direct measure MGO only – very different scale
 - NPA/UMF® 5+ = MGO 83
 - NPA/UMF® 10+ = MGO 263
 - NPA/UMF® 15+ = MGO 514
 - NPA/UMF® 20+ = MGO 829

Non-peroxide activity (NPA)

Very active, even after hydrogen peroxide removed

- stable, can be sterilised, ideal for medicinal use

Most famous example - *Leptospermum* honey from NZ and Aus

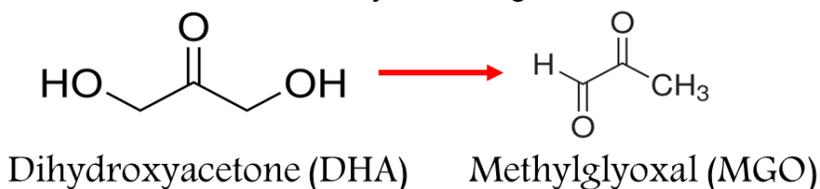
- manuka and jellybush

Note:

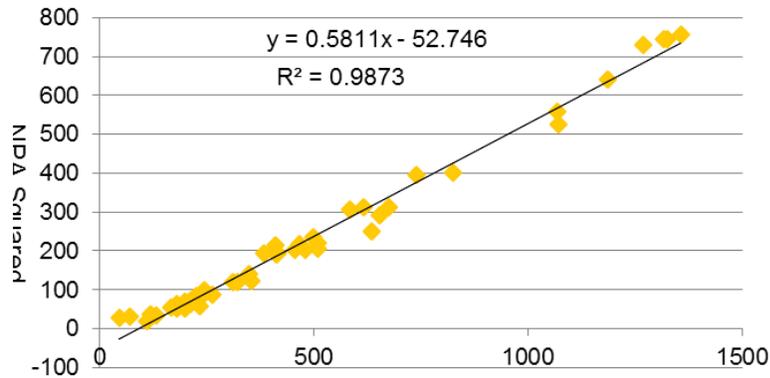
- Not all tea tree are *Leptospermum*
- But all *Leptospermum* are Tea Tree

MGO and NPA/UMF

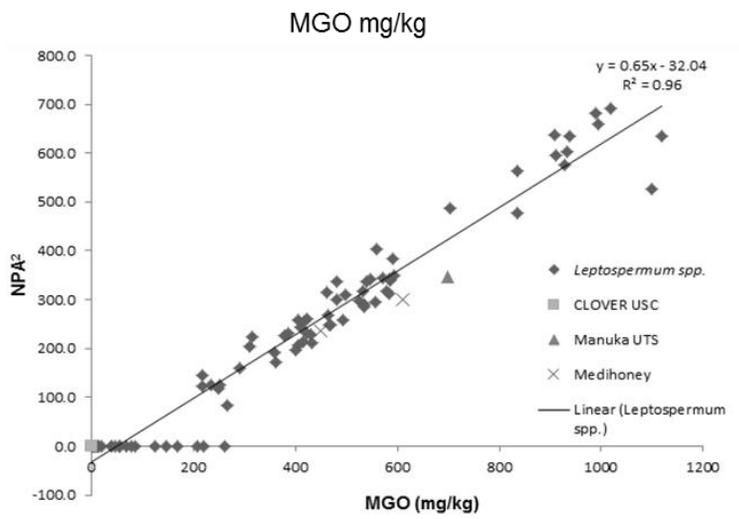
- High MGO levels in NZ manuka honey → related to non-peroxide activity (NPA)
- MGO comes from naturally occurring DHA in nectar



MGO Conversions to NPA/UMF



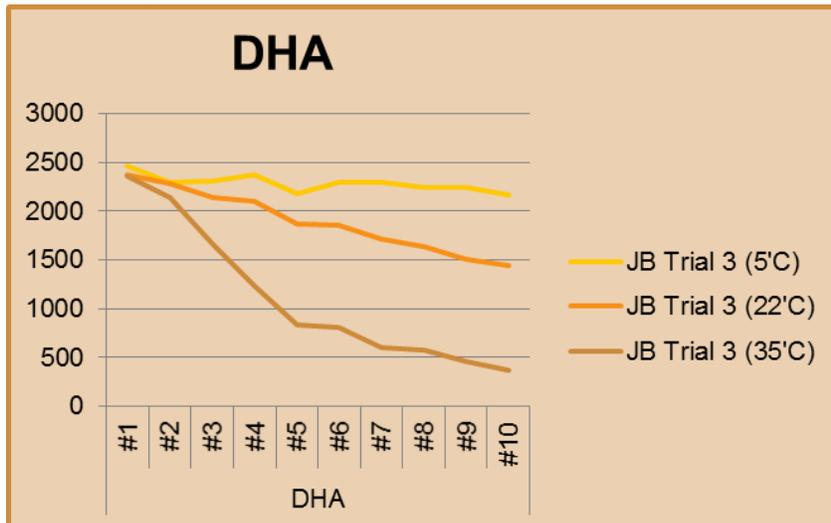
Univ. Waikato data,
NPA/UMF squared vs MGO



The anti-bacterial activity is due to
MGO

Aust. Data, NPA squared vs MGO

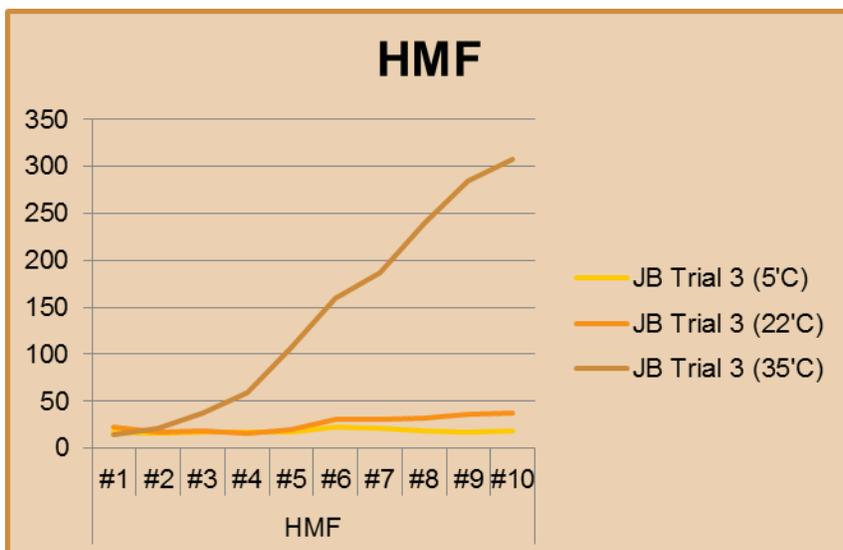
Maturing *Leptospermum* Honey.





Capilano Honey & Univ. Sunshine Coast

There is a common myth that heating leptospermum honey will accelerate the conversion of DHA to MGO. This is not the case. We've tested this. Honey was stored for 10 months at 3 temperatures. Storing at 5 degrees showed little change over the 10 months. Long term storage at 35 degrees shows a reduction in DHA and MGO with an increase in HMF. For overseas export many countries won't accept honey with a HMF level over 40ppm. Short term heating for packing is fine but it is recommended to keep the honey at around 22 degrees for maturing for the best DHA to MGO conversion



Maturing Leptospermum Honey

What will my honey go in 6 – 12 months?

Ten young honeys;

Average: 1760 ppm DHA & 260 ppm MGO

Stored 12 months @ 22°C

Average DHA loss 44% (range 33-52%)

Average MGO Conversion 40% (range 34-61%)

Final Average: 988 ppm DHA & 561 ppm MGO

Young Leptospermum honeys have a large amount of DHA and little MGO. Over about 12 months the honey matures with the conversion of DHA to MGO. Generally, about 40% of the DHA is lost and of that lost 40% becomes MGO. There are multiple chemical reactions occurring in the honey which is why not all the DHA goes to MGO .

Capilano Honey & Univ.
Sunshine Coast

Predicting MGO

Often asked what will my honey go to after x time
This is very ROUGH

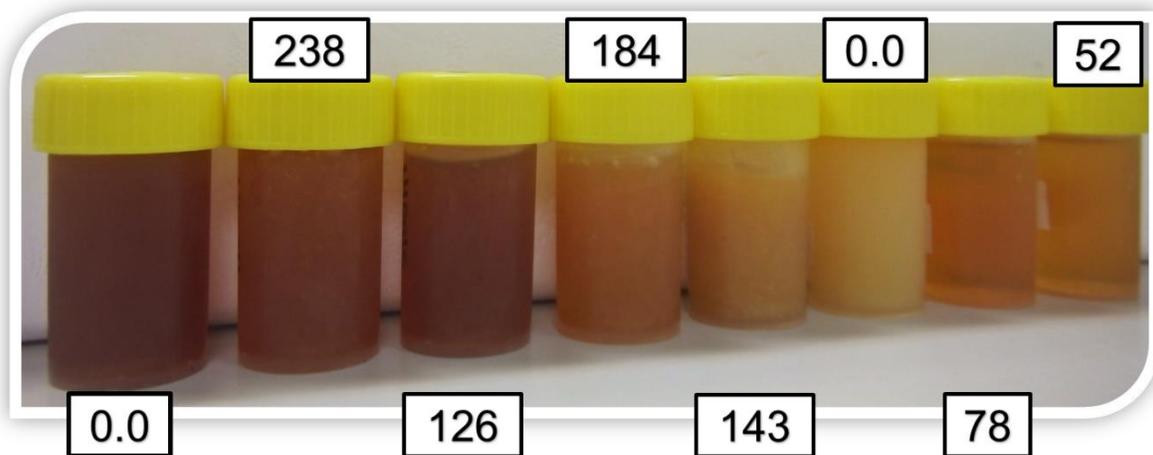
$$\text{DHA} \times 0.16 + \text{MGO} = \text{MGO when mature}$$

There are many factors that can affect this:

- Storage temperature
- Starting composition
- Generally won't go pass a DHA:MGO of 2

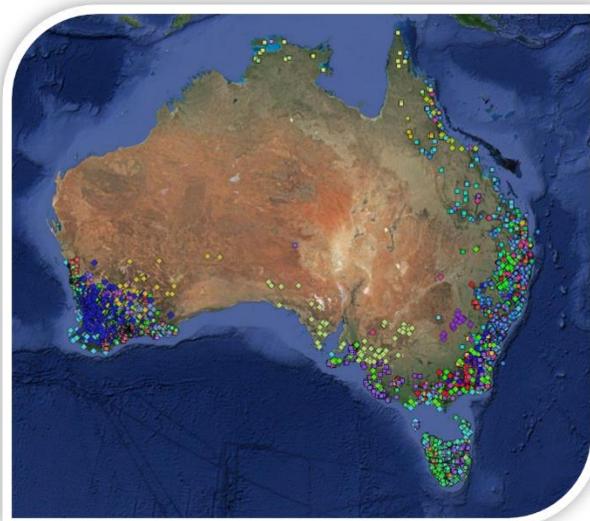
We often get asked what honey will go to in 12 months. This is important as if the DHA isn't high enough it may be better off selling the honey when collected rather than storing it. This is only a very rough conversion, storage temperature, starting composition and possibly species may affect what the honey will go to. Generally it will level off at a ratio of DHA: MGO of 2

MGO in Honey



NZ Manuka honey is generally thought of as a dark thick honey. These are some samples that have been received so far. As you can see they have a range of colours. We can see that colour is not a good indication of activity. Australian *Leptospermum* honeys break the Manuka mould of a dark thick honey

Leptospermum in Australia

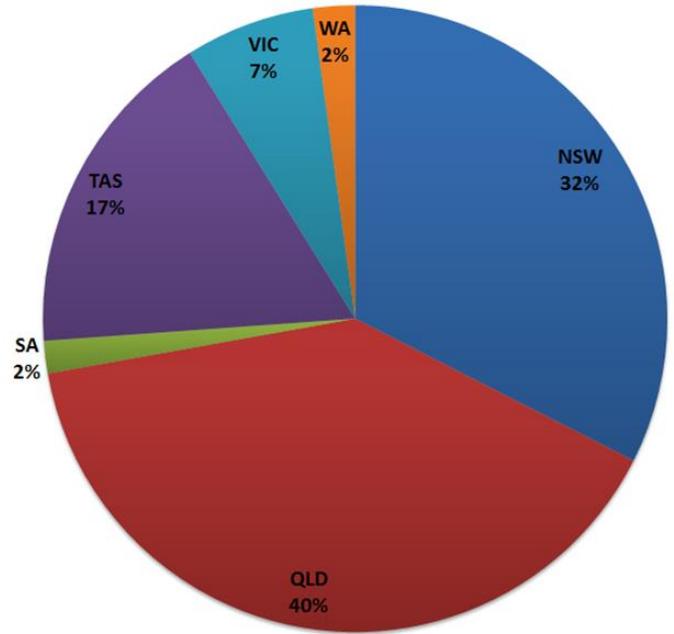


- About 87 different species in total
- 45 species tested so far from around Australia

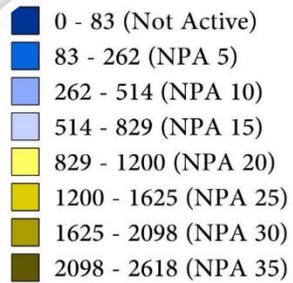
Project progress Honey Samples

- Collection started March 2015
- ~600 honey samples collected
- A big THANK YOU to those who have donated samples

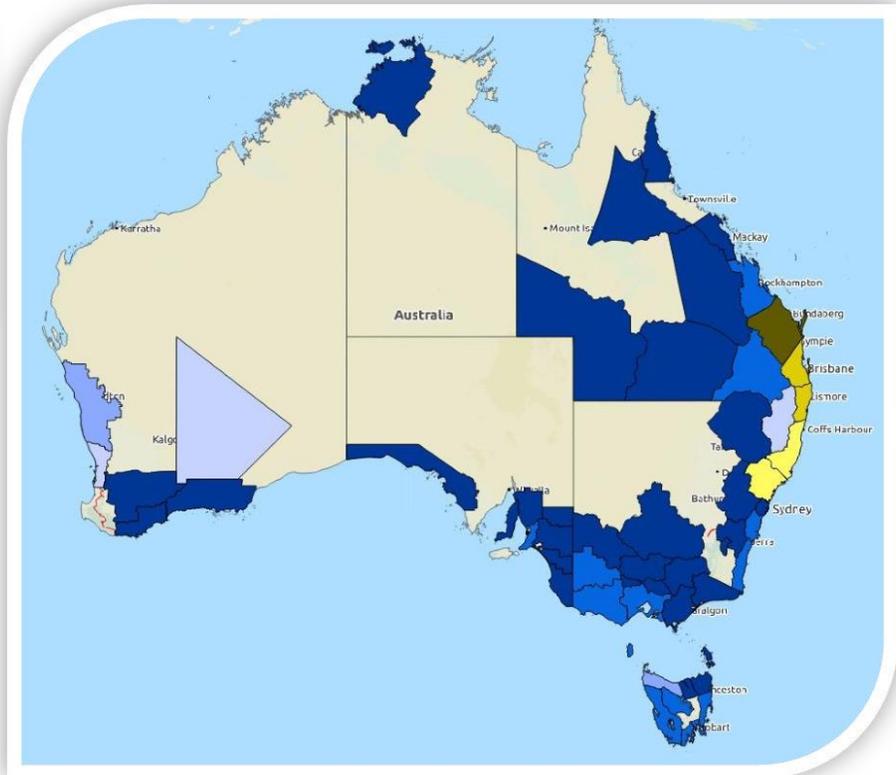
Percentage of Australian *Leptospermum* honeys received by state
November 2016



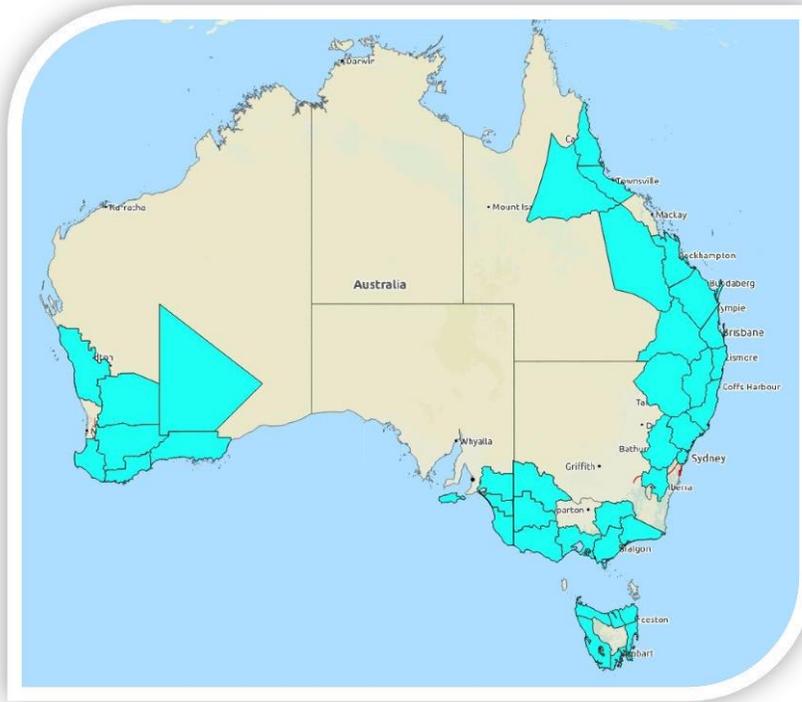
Max Honey Activity Recorded



- Beekeepers still learning what is a *Leptospermum*
- Expecting higher activities over the course of the project



Nectar Field Work



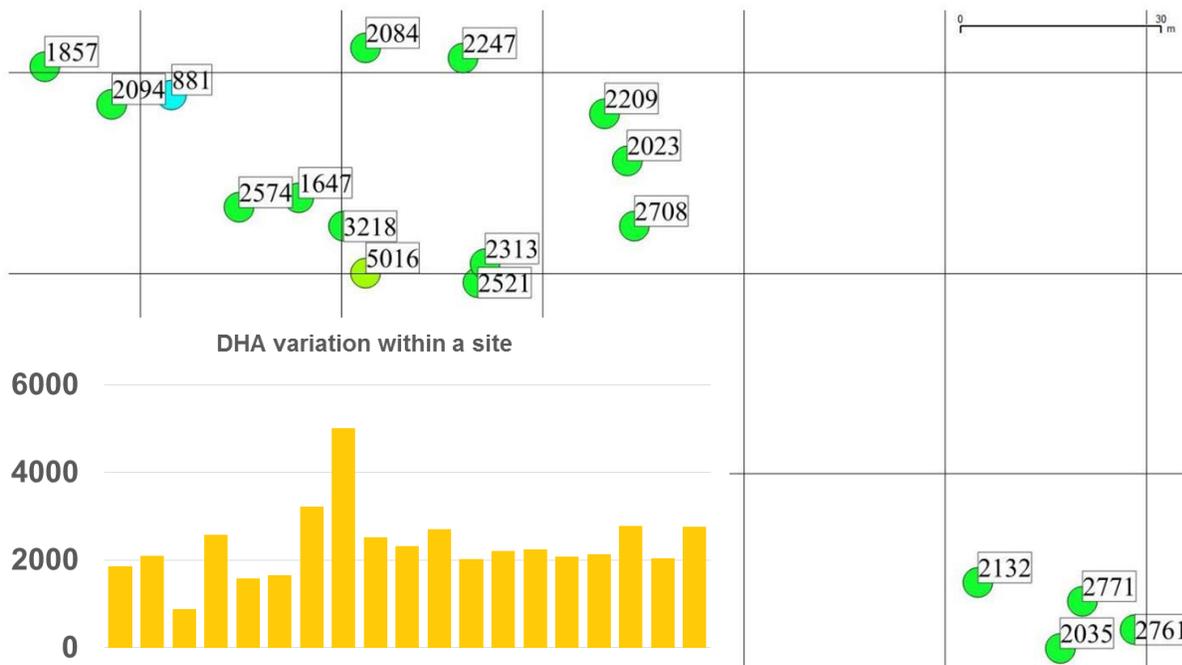
Been supported by Collaborators throughout Australia

Nectar Samples

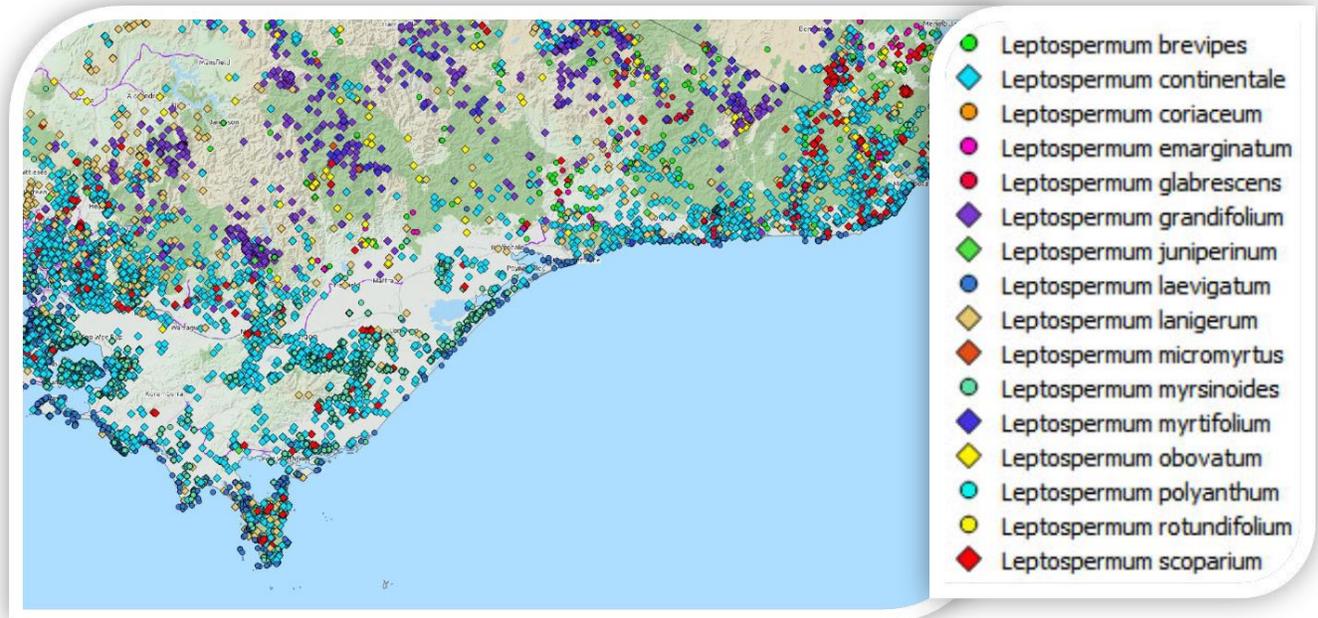
Overall:

- Approximately 1725 trees tested
- 57 different species tested, 45 Leptospermum / 12 non-Leptospermum

Variation within a Site



Leptospermum in Gippsland



Information derived from <http://www.ala.org.au/>

<i>L. brevipes</i>	<i>L. juniperinum</i>	<i>L. obovatum</i>
<i>L. continentale</i>	<i>L. laevigatum</i>	<i>L. polyanthum</i>
<i>L. coriaceum</i>	<i>L. lanigerum</i>	<i>L. rotundifolium</i>
<i>L. emarginatum</i>	<i>L. micromyrtus</i>	<i>L. scoparium</i>
<i>L. glabrescens</i>	<i>L. myrsinoides</i>	
<i>L. grandifolium</i>	<i>L. myrtifolium</i>	

From our fieldwork so far we've test 11 out of the 16 species found in Gippsland. However, it should be noted that not all of the samples for some of the species came from Gippsland so there could be a regional effect that we are unaware of at the moment.

Leptospermum DHA in QLD

Species	Not Detected	Low (>1000ppm)	Medium (2000 -10000 ppm)	High (10000 ppm)
<i>L. brevipes</i>		779		
<i>L. continentale</i>			3218	
<i>L. coriaceum</i>	ND			
<i>L. grandifolium</i>			2965	
<i>L. Juniperinum</i>			4297	
<i>L. Laevigatum</i>	ND			
<i>L. lanigerum</i>			3866	
<i>L. myrsinoides</i>	ND			
<i>L. myrtifolium</i>			1949	
<i>L. polyanthum</i>			2685	
<i>L. scoparium</i>			2151	

Though some of the native Gippsland species do not have the same level of DHA as some of the species on the East Coast like *Leptospermum polygalifolium* which is about 8000ppm. They still have comparable activity to the *Leptospermum scoparium* in New Zealand. It should also be mentioned that for some of these species we still need more samples and it wouldn't be surprising if some of these averages may increase with more testing.

Things to keep in Mind

- What else is in flower?
 - Is it an off year?
- Is there enough moisture?
 - Did it occur at the right time?
- Will it be warm enough?
- Will it be dry enough?
- Are there other pollen sources?
 - Will I need to feed pollen?
- Do I have enough Hives?
- Do I have the right species?
- Are the conditions right for me to get a good crop?
- Am I better off going after something else?
- Not every year maybe a *Leptospermum* year

How can Beekeepers Help?

- Provide Honey samples with location and species information
- Lets us know when and where local *Leptospermum* species are in flower
- Host and show us around Apiary Sites, where we can aid in identifying trees and take samples

Honey Samples

Require:

200g to 500g of Honey (Filtered where possible)

Along with some information about the apiary site

- ! All Site Information will be Coded and Restricted to the Researchers Involved in the Project!
- For Publications Data will be Averaged Over Regions
- All donated honeys will have their MGO, DHA and HMF values tested and numbers supplied to the Bee Keepers at no cost.
- Samples that arrive without paperwork or proper location information, may have their testing delayed until this is received

Honey Sample Forms

Available from:

Simon Williams

0459336779

Simon.Williams@research.usc.edu.au

Nural Cokcetin

0405 284 718

Nural.Cokcetin@uts.edu.au

Can be collected after the talk

Looking for sources of active Australian *Leptospermum* honey
Sample information sheet

Thank you for supplying honey for the research project looking for sources of active Australian *Leptospermum* honey.

Please return this information sheet with your 200 - 500g **honey sample**.

- If you are supplying more than one honey sample, please fill in a separate sheet for each one and label the different samples.

If possible, please also include **plant sample(s)** of the *Leptospermum* that the bees collected the nectar from (branch with bark, leaves, flowers and/or nuts), and a **nectar sample**.

- If you are supplying more than one sample, please label the different samples.

Our postal address

Attn: Nural Cokcetin
iThree institute
University of Technology Sydney
PO Box 123
Broadway NSW 2007

Beekeeper contact details

Name	
Phone number	
Address	
Email address	

Note: When we report on our findings, the data we generate will be pooled without identifying specifics of your sample(s). All of the information you supply will be in confidence and will not be available to anyone outside of our research group without your permission.

Sample information

Sample number (if more than one supplied)	
Floral source	
Scientific name (if known)	
Location of the floral source (please be as specific as you can)	
Approximate date of collection from hives	
Has the honey been sitting in storage since extraction, and if so under what conditions e.g. temperature and in what sort of containers?	
Any other information you feel might be relevant e.g. Were other <i>Leptospermums</i> flowering in the area? Was there significant flowering from other species in the area, and if so which ones? Any exposure to chemicals (insecticides, pesticides etc.) or antibiotics (e.g. OTC)?	

Please phone or email us if you have any queries, and thank you once again for your help.

For project info and honey samples - Nural Cokcetin or Shona Blair Nural.Cokcetin@uts.edu.au or Shona.Blair@uts.edu.au 0405 284 718 or 0422 977 510	For nectar samples - Simon Williams Simon.Williams@research.usc.edu.au 0459 336 779
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Looking for more sources of active *Leptospermum* honey - sample information sheet

General Identification



Flowers

- 5 petals
- Stamens shorter or similar size to petals
- Open dish shape

Leaves

- Alternate



Alternate



Woody



Fleshy

Fruit

- Woody or Fleshy
- Vertically divided (3-10) splits

Leptospermum scoparium

Aka: Mānuka, Prickly tea tree

- Prickly Leaves
- Wooden Fruit
- White sepals
- Wider leaf (arrow like)

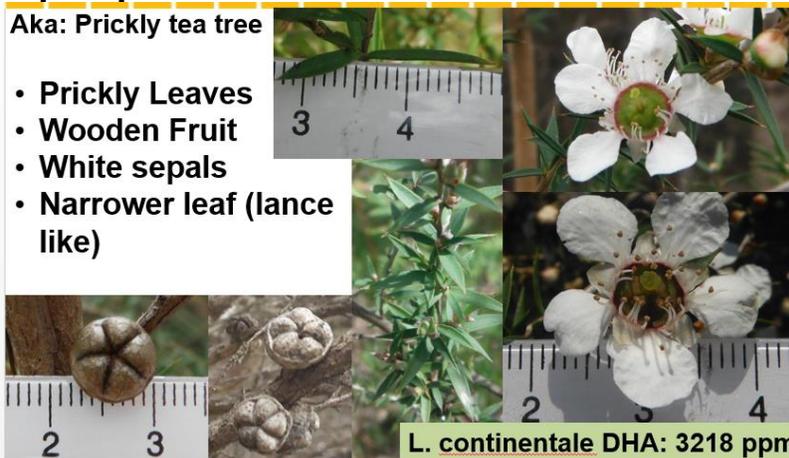


DHA: 2151 ppm

Leptospermum continentale

Aka: Prickly tea tree

- Prickly Leaves
- Wooden Fruit
- White sepals
- Narrower leaf (lance like)



L. continentale DHA: 3218 ppm

Leptospermum juniperinum

- Aka: prickly tea tree
- Prickly leaves
 - Woody seed



Leptospermum myrtifolium

Aka: Grey Tea-tree



Leptospermum lanigerum

Aka: Woolly tea tree

- Woolly Fruit
- Peeling Bark
- Red hairy sepals
- Grey/ green leaves
- Leaves have woolly bottoms



Leptospermum grandifolium

Aka: Alpine Woolly tea tree

- Woolly Fruit
- Peeling Bark
- Red hairy sepals
- Grey/ green leaves
- Leaves have woolly bottoms

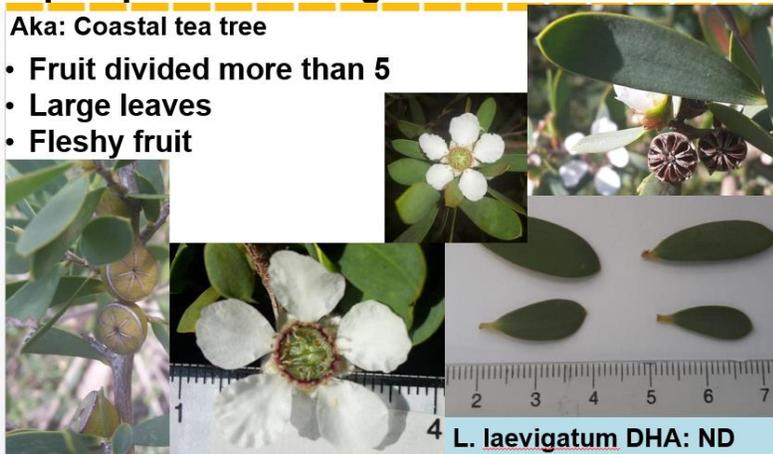


L. grandifolium DHA: 2965ppm

Leptospermum laevigatum

Aka: Coastal tea tree

- Fruit divided more than 5
- Large leaves
- Fleshy fruit



L. laevigatum DHA: ND

Leptospermum coriaceum

Aka: Green tea tree

- Similar to *L. laevigatum*
- Fruit divided more than 5
- smaller leaves
- Fleshy fruit



L. coriaceum DHA: ND

Leptospermum myrsinoides

Aka: heath tea tree, Silky tea tree

- Fruit divided by 5
- Small leaves
- Fleshy fruit



Leptospermum brevipes



Tree ID Information

Require:

Photos of Flowers, Leaves and Seed Capsule (if present)



When does the tree flower?

Where the tree is

Project End Goals

- To determine the Activity of the many Australian Leptospermum Species
- Identify new Areas for Active honey production
- Create a Guide to allow Beekeepers to identify active Leptospermum species
- Identify Leptospermum Species Suitable for Plantation Plantings
- To tell the Story of Australian Active Leptospermum Honey

Planting for Bees

Reading Material



RURAL INDUSTRIES
Research & Development Corporation



Bee Friendly: A planting guide for European honeybees and Australian native pollinators



Australian Government
Rural Industries Research and Development Corporation



FAT BEES
SKINNY BEES

a manual on honey bee nutrition for beekeepers

A manual for the Beekeepers
Research and Development Corporation



Dr. Greg Suter
Honey Bee Nutrition Centre
2012, Canberra, ACT 2600

Fat Bees Skinny Bees - a manual on honey bee nutrition for beekeepers

What is your aim

Are you planting to:

- Provide year round floral resources?
- Provide floral resources at a fixed time of year?
- Increase honey production?
- Increase bee numbers?
- Target a specific floral honey?

Selecting Plants

Bees are not native to Australia

- Australian plants did not evolve with bees so sometimes lack certain bee essential components

Flowering Calendar

- Determine when your local plants flower
- Identify holes in the flowering
- Select plants that complement or fill in the gaps

Understand your local environment

- Plants have different water requirements

- Plant flowering and nectar production can be dependent on water availability
- Based on beekeeper knowledge and research you can select plants for nectar, pollen or both

Hive placement

- Hives are generally positioned to get morning sun and afternoon shade
- Plan for sufficient access to hives
- Ensure when hives are onsite there will be water for them
- Avoid placing hives where they will be encouraged to fly directly over homes or busy roads

Leptospermum Plantations

- Many species that can be looked at
 - Some species very robust
 - Grow over a large range of conditions
- Can plant for an extended season using multiple species
- Leptospermums generally are not good pollen producers
 - Co-flowering pollen producers
 - Feeding bees pollen supplement if not enough pollen available
- Bees require food all year, other plants required if you don't want to move hives
- Water will be required to set flowers and allow production of nectar
- Compared to some Australian species Leptospermums are poor honey yielders
- Bees can fly over 5 km, to ensure a monofloral honey you will need a large area planted or have limited competing floral resources
 - Smaller areas will supplement natural occurring crops
- Stocking rates are currently 2-3 hives per Hectare
- Will it work?
- No confirmed evidence yet, however the research that has been published in New Zealand and the push for plantations suggest that trials in New Zealand must have been successful
- Genetic link to DHA production, New Zealand has been doing plant breeding and appear to be getting positive results. Australia is beginning breeding programs now

Project Support



RURAL INDUSTRIES
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Australian Government
Rural Industries Research and
Development Corporation

A big THANK YOU to everyone who has
provided assistance and information so far
for the project



NOT GETTING LOCATION
INFORMATION



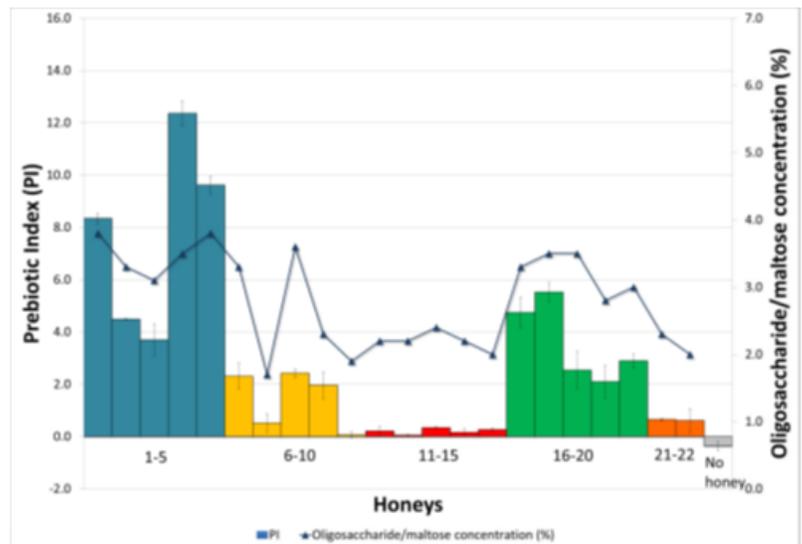
Questions ?

Simon Williams
04 5933 6779

Simon.Williams@research.usc.edu.au
<https://ozhoneyproject.wordpress.com/>
<https://www.facebook.com/USCHoneyLab/>

Prebotic Honey

- Australian honeys:
have prebiotic activity
oligosaccharides
- deliver health benefits
- could be an effective
functional food
ingredient



Helpful Sources

www.leptospermum.com.au Information about plantations

<http://keybase.rbg.vic.gov.au/> Plant identification keys

www.ala.org.au Species herbarium records

Bottlebrushes, Paperbarks and Tea Trees, and all other Plants in the Leptospermum Alliance Wrigley, J.; Fagg, M.