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Chemical Diversity and Anti-fungal Action of Kānuka (Kunzea ericoides from different geographical locations in New Zealand

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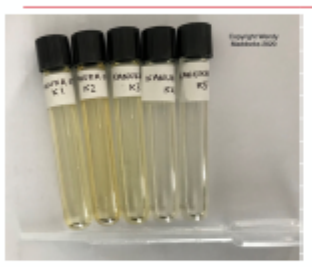
BACKGROUND

Kānuka, *Kunzea ericoides* (A. Rich) Joy Thomps. is a common scrub tree native to New Zealand. Its normal habitat spreads from the Far North down to most of the South island. It is not generally found on the West Coast of North Island or the lower South island. An essential oil has been commercially produced in New Zealand since the early 1990's. Long history of use in traditional Māori healing and has several traditional names e.g makahikatoa (white kahikatoa). Current name confirmed in 1983 with chromosomal mapping and genetic markers. Essential oil is obtained from the flowering branches and the tree regenerates quickly. Commercially oil is distilled by 8-10 producers around the country + many craft distillers

Chemical Diversity of *Kunzea ericoides* five samples from different geographical locations independently analysed(1)



K2 (aged branches) Great Barrier Island (www.barriergold.co.nz)
K3 -East Coast North Island (www.manukaessentials.com)
K4-Coromandel North Island (www.kanukaoilnz.com)
K5Arapaoa (Arapawa) Island (www.mshop.co.nz)
(1) Analysis conducted by www.flinderscook.co.nz

	CAS No.	K1	K2	K3	K4	K5
Specific gravity (SG)		0.8833	0.8779	0.8838	0.8741	0.8725
Refractive index (RI)		1.4712	1.4701	1.4728	1.4683	1.4682
Constituents >0.3%						
alpha pinene	80-56-8	71.68	74.34	60.12	74.08	70.64
o-cymene	527-84-	1.14	1.27	2.99	0.44	3.95
eucalyptol	4470-82-6	5.95	5.58	5.51	6.6	4.34
linalool	78-70-6	2.49	2.57	1.81	4.45	1.93
alpha terpineol	98-55-5	1.39	0.94	1.06	1	0.8
viridiflorene	21747-46-6	1.39	0.15	2.95	0.61	0.95
cis calamenene	72937-55-4	1.72	1.38	1.9	0.92	1.21
spathulenol	1139-30-6	1.35	0.64	0.94	0.75	0.5
viridiflorol	552-2-3	4.11	1.06	3.5	2.32	1.3
ledol	577-27-5	0.99	0.35	0.87	0.64	0.34

For full discussion on the chemical differences see Maddocks. W (2021) "Diversity in the essential oil of New Zealand grown Kānuka, Kunzea ericoides (A. Rich) Joy Thomps" *American Journal of Essential Oils and Natural Products (AJEONP)* https://www.essencejournal.com/archives/2021/9/1/A (open access online version)

Method

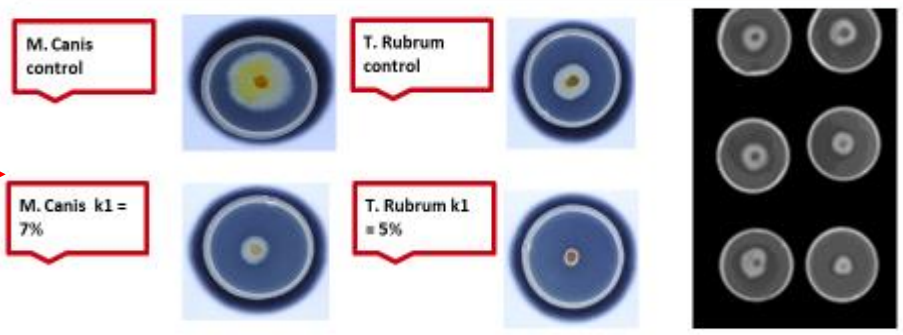
1.100ml of essential oil produced in last year was purchased from four commercial distillers who had sufficient commercially available quantities for sale, had previously tested their oil for purity and authenticity and could supply GPS & other harvesting details. Oils sent for independent analysis to FlindersCook Technical Services

2. Each oil diluted in fractionated coconut oil (FCO) at between 1-40% to determine optional dilution for efficacy

3. Stock cultures of *M. canis* and *T. rubrum* were maintained on PDA agar plates., a 5 mm cork borer was used to take a mycelial plug from the growing edge of a stock culture. The plug was then transferred to the centre of a 60 mm diameter Petri dish that contained 5 mL of solidified PDA agar media. Prior to inoculation 50 mL of oil was added at the required concentration and this was spread smoothly over the surface of the agar using a sterilised glass spreader. Plates were incubated at 21°C for seven days prior to imaging.

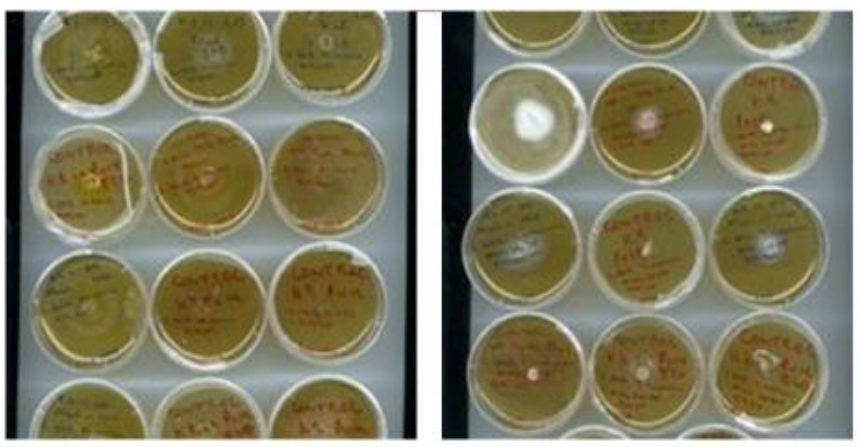
4. Each dilution was replicated 3-6 times for validity and an average taken of measures of radial growth

Results

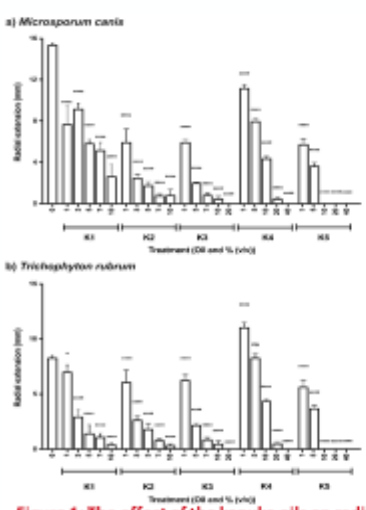


Representative images of mycelia of Microsporum canis and Trychophyton rubrum grown in the presence of kanuka. Images were photographed and converted to 8 bit images using Fiji. No adjustments have been made to brightness or contrast in the presented images. Control plates were treated with fractionated coconut oil.

Sample Plates M. canis (L) and T. rubrum (R)-each plate labelled at time of inoculation and left sealed in incubator



Results



For both species, the oils significantly reduced radial extension in a dose- dependent manner. The most effective oils were K2 and K3 (IC_{50} values of 0.67 and 2.7% (v/v) (K2) and 0.7 and 2.7% (v/v) (K3)) for *M. canis* and *T. rubrum* respectively and the least effective oil was K4 (IC_{50} values of 6.3 and 16.8% (v/v) for *M. canis* and *T. rubrum* respectively). For *T. rubrum*, K4 significantly increased growth at 1% (v/v) and had no effect at 5% (v/v), relative to the control. Four of the oils (K2, K3, K4 and K5) were more effective against *M. canis* than *T. rubrum* with lower IC_{50} values, while K1 was more effective against *T. rubrum*

Figure 1: The effect of the kanuka oils on radial expansion of *Microsporum canis* and *Trychophyton rubrum*. Each of the oils reduced radial extension rates in a dose dependant manner. Control plates were treated with fractionated coconut oil. Data are presented as mean + SEM. Based on ANOVA and Tukey tests significant differences relative to the control are indicated as **** P<0.0001 and * P<0.05.

Discussion

- Each oil had some effect against the two pathogenic dermatophytes, however these were dose dependent- however there was a maximum dose beyond which no further efficacy was observed therefore more is not always better
- A higher alpha pinene content was not an indicator or efficacy against the two fungi
- Each oil had different constituents not present in other oils as these may have impacted on the response to the fungi both in a positive or negative way
- The usual skin dilution would be 10% or less and the higher dilutions were tested to find out at what dose a low efficacy oil would have an affect (up to 40%)
- Knowing the geographical location and chemical analysis of Kunzea ericoides is important when making a therapeutic formulation

Acknowledgements: This study was funded by Dr. Wendy Maddocks' University research funds. We would like to thank Matt Walters (University of Canterbury) for help with imaging.

Please see Dr. Wendy Maddocks, Dr. Ayelen Tayagui, Briar Collins, Olivia Williams, Dr. Ashley Garrill. Evaluating the effects of kānuka essential oil (Kunzea ericoides) grown in different locations in New Zealand on two pathogenic dermatophytes: An in vitro study. Am J Essent Oil Nat Prod 2021;9(2):28-33. Available online at www.essencejournal.com