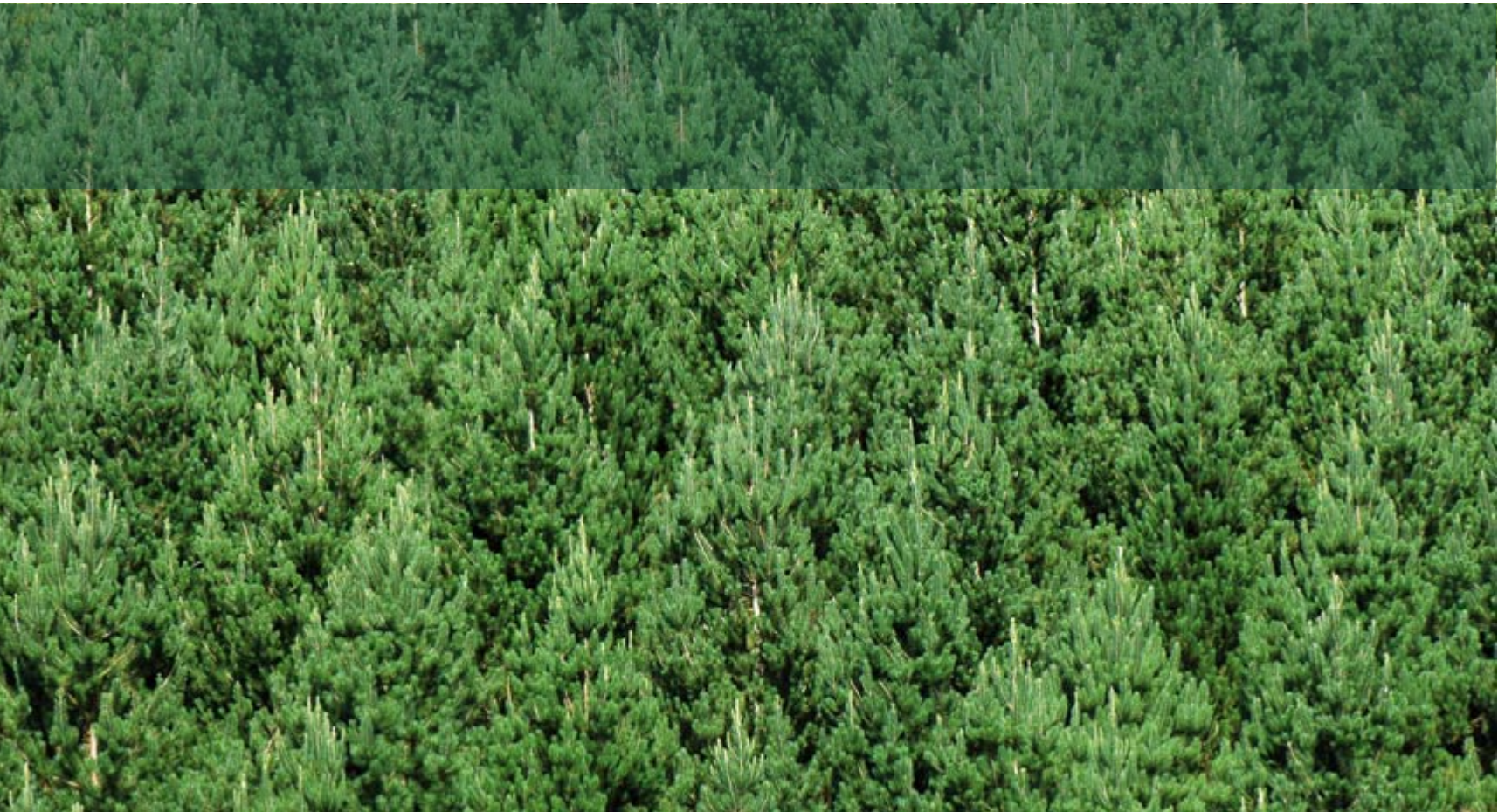


# **Antifungal activity of essential oils against common wood degrading/decaying fungi**

**Tripti Singh and Colleen Chittenden**



# Introduction

- Prohibition of traditional preservatives (eg. CCA) increases focus on developing benign alternatives
- Essential oils
  - ▶ Natural plant extract
  - ▶ Well known antimicrobial agents
  - ▶ Commonly used in pharmaceutical and food industry as a preservative



# Aim

- To evaluate the antifungal activity of essential oils as a potential wood preservative



# Materials and Methods

- 12 essential oils screened in nutrient medium against 8 common wood degrading/decaying fungi.
- Eugenol was evaluated for decay resistance using both unleached and leached cycle on radiata pine sapwood blocks against 3 brown rot fungi



# Growth inhibition measurements on nutrient medium

- Experiments performed in 2 sets
  1. Medium amended with 1%v/v essential oils
  2. Essential oils with antifungal activity at 1%v/v also tested at 0.5%v/v
- Colony diameter recorded for 6 weeks
- The results were expressed in terms of growth of test fungi (+) or inhibition of growth (-)



# Results

- Screening of essential oils at 1%v/v
  - ▶ Variability in the tolerance of the tested fungi against essential oils apparent



## Effect of different essential oils at 1% v/v on growth of test fungi after 6 weeks incubation

Essential oils	Test fungi							
	<i>O. placenta</i>	<i>C. puteana</i>	<i>A. Xantha</i>	<i>O. floccosum</i>	<i>O. picea</i>	<i>S. sapinea</i>	<i>L. procerum</i>	<i>T. harzianum</i>
Tea tree	+	+	+	-	+	+	-	+
Eucalyptus	+	+	+	+	+	+	+	+
Aniseed	-	-	- (+)	+	+	+	+	+
Geranium	-	-	-	-	-	-	-	-
Cinnamon	-	-	-	-	-	-	-	-
Kanuka	+	-	+	+	+	+	+	+
Oregano	- (+)	-	-	+	+	- (+)	+	+
Olive leaf	+	+	+	+	+	+	+	+
Manuka	+	-	+	+	+	+	+	+
Kolrex	+	+	+	+	+	+	+	+
Lema	+	-	-	-	-	-	-	+
Eugenol	-	-	-	-	-	-	-	-

**Note :**  
 + indicates growth.  
 - indicates no growth.  
 - (+) indicates out of 5 plates one or two plates had growth.

# Results

- Screening of essential oils at 1%v/v
  - ▶ geranium, cinnamon leaf and eugenol inhibited the growth of the test fungi
  - ▶ eucalyptus, olive leaf and kolrex were unable to restrict the growth of any test fungi
  - ▶ Others showed selected activity



## Effect of different essential oils at 0.5% v/v on growth of test fungi after 6 weeks incubation.

Essential oils	Test fungi							
	<i>O. placenta</i>	<i>C. puteana</i>	<i>A. Xantha</i>	<i>O. floccosum</i>	<i>O. picea</i>	<i>S. sapinea</i>	<i>L. procerum</i>	<i>T. harzianum</i>
Aniseed	+	-	- (+)	NA	NA	NA	NA	NA
Geranium	-	-	-	-	-	-	-	-
Cinnamon	-	-	-	-	-	-	-	-
Oregano	+	-	(+) -	NA	NA	NA	NA	NA
Lema	+	-	-	+ (-)	-	+ (-)	-	+
Eugenol	-	-	-	-	-	-	-	-

Note :  
 + indicates growth.  
 - indicates no growth.  
 - (+) indicates out of 5 plates one or two plates had growth.

# Results

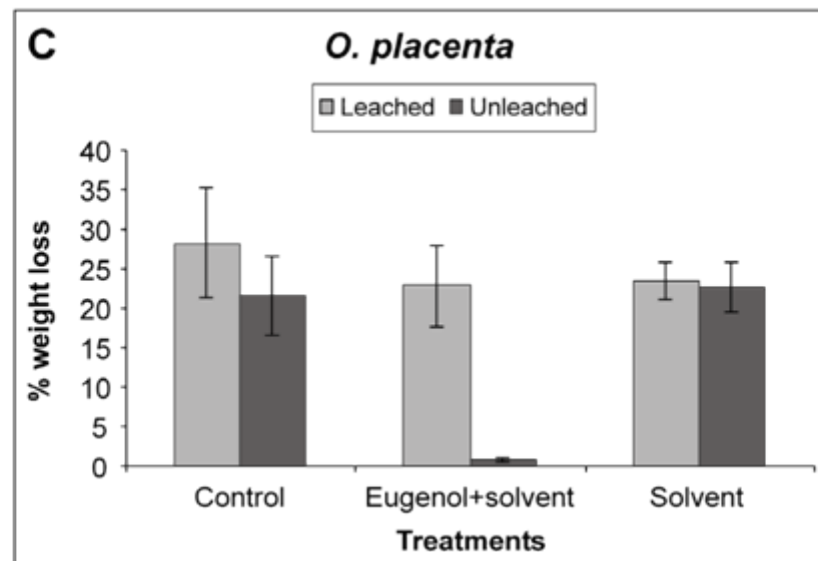
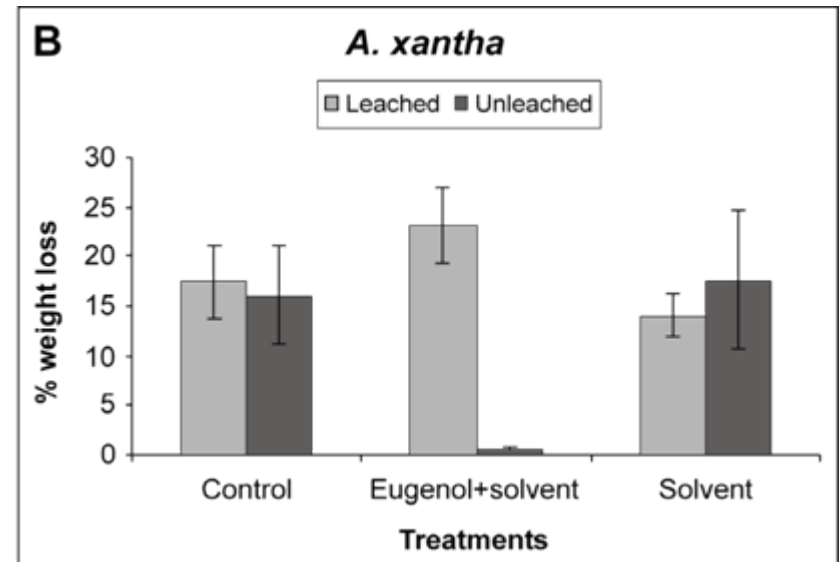
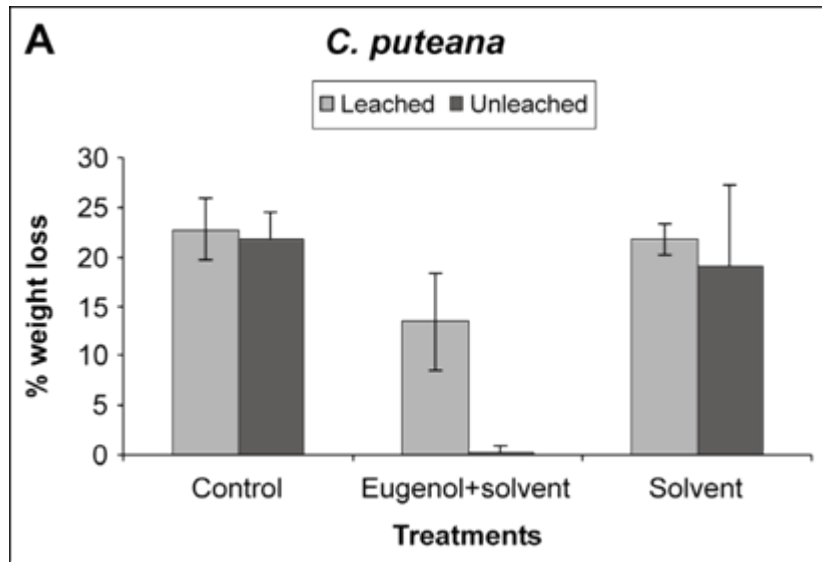
- when selected oils were tested at 0.5% v/v
  - ▶ geranium, cinnamon and eugenol did not show any growth
  - ▶ aniseed, oregano and lema showed mixed inhibitory results against selected fungi



# Wood decay resistance test

- The efficacy of eugenol was evaluated using a standard sutter block durability test
  - ▶ against *Oligoporus placenta*, *Coniophora puteana* and *Antrodia Xantha*





# Results

- Blocks treated with eugenol, without leaching, had less than 1% weight loss
- However leached blocks, treated with eugenol had 13.42 to 22.81% weight loss, clearly indicating the high leachability of eugenol.



# Conclusions

- Differences in the antifungal activity of essential oils were observed;
- Out of the 12 essential oils screened against 8 wood degrading fungi, three of the essential oils showed complete inhibition of test fungi at 0.5% v/v.



# Conclusions

- Wood durability testing identified eugenol as a potential wood preservative to confer decay resistance where there is a minimal leaching hazards e.g. New Zealand hazard class H1.2
- However, to be used for higher decay hazard situations, further work for *in-situ* polymerization of eugenol to fix active(s) in wood is required.

