Effect of *L. terebrantis* on the production of defensive chemical compounds in *P. taeda*

John K. Mensah[1], Ryan L. Nadel[1], Emily Carter[2], Zhaofei Fan[1], Mary A. Sword Sayer[3] and Lori G. Eckhardt[1]

[1]School of Forestry and Wildlife Sciences, Auburn University, Auburn, Alabama; [2]USDA Forest Service, Southern Research Station, Auburn, Alabama; [3]USDA Forest Service, Southern Research Station, Pineville, Louisiana

Introduction

Chemical defensive responses

- Constitutive
- Induced

Induced chemical responses

- Protein based
- Non-protein based

Chemical compounds - terpenes and phenolics possess antimicrobial properties

Introduction

Specific and toxic

Bind hydrolytic enzymes and proteins

Inhibit spore germination

Prevent mycelial growth

Quantity and quality of induced chemical compounds in plant may be altered during pathogen attack

Objectives

Determine the effect of *L. terebrantis* inoculum density on the induction of oleoresins and total phenolic compound (catechin) in mature loblolly pine trees

Assess the fungistatic effect of catechol on the growth of *L. terebrantis* on Malt Extract Agar

Hypotheses

Hypothesized that *L. terebrantis* infestation will induce oleoresin and catechin production, and result in tree growth decline as carbon is reallocated for synthesis of defensive compounds

In addition, a positive linear relationship would exist between induced oleoresins and total phenolics

MEA amended with catechol will suppress radial growth of *L. terebrantis, L. procereum, G. alacris*

Methods - Oleoresins

North-south sides of each tree were sampled by punching a hole with 1.9 cm diameter arch punch at DBH

A plastic connector was screwed into the tree to direct resin into a pre-weighed plastic tube attached to the connector

Tubes were removed after 24 hrs and transported

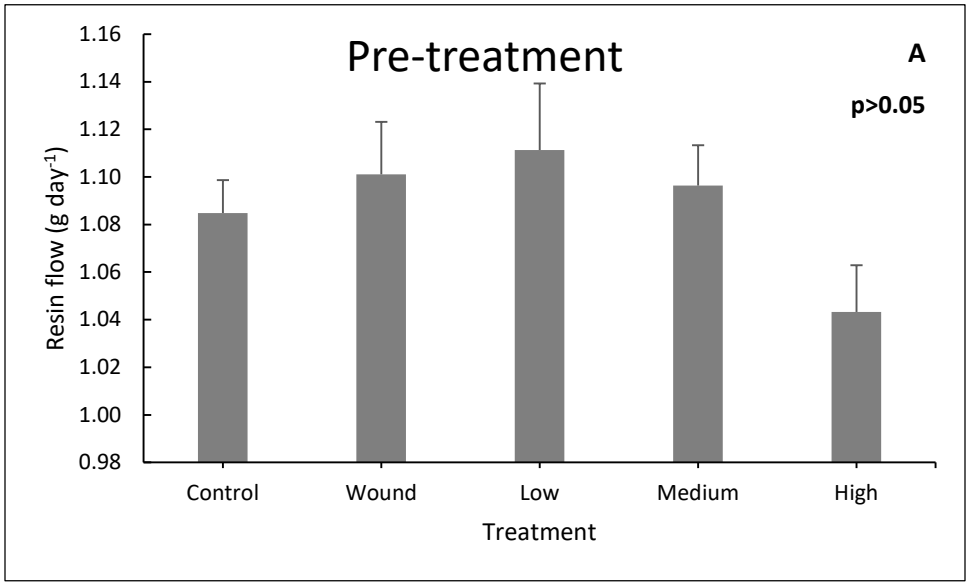
Average resin weights were determined

Methods - Phenolics

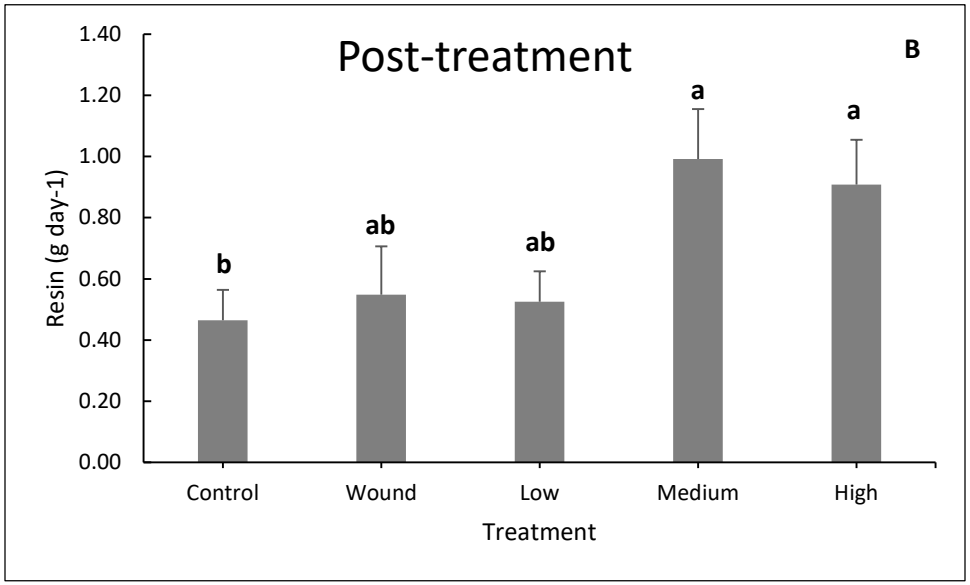
- Folin-Ciocalteu method
- Development - Na_2CO_3
- Absorbance - Spectrophotometry

Results – Oleoresins induction

Pre-treatment oleoresins



Induction of oleoresins following inoculation of loblolly pine with *L. terebrantis*



Results – Oleoresins

Inoculation zone

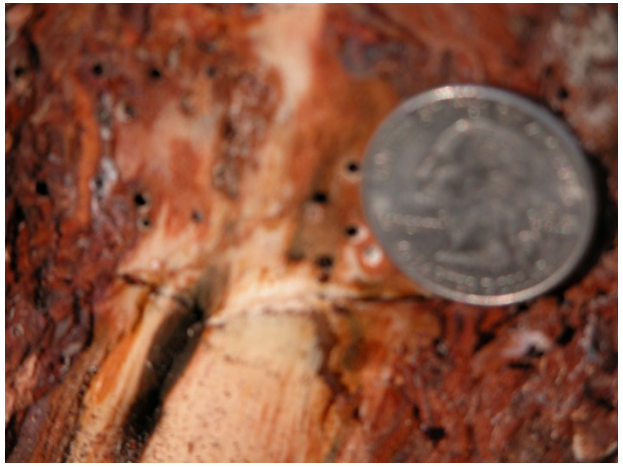
Resin crystals in phloem tissues

Staining & Resinosis in butt and roots caused by *Leptographium* spp. & insect feeding

Butt of 20 yr old longleaf

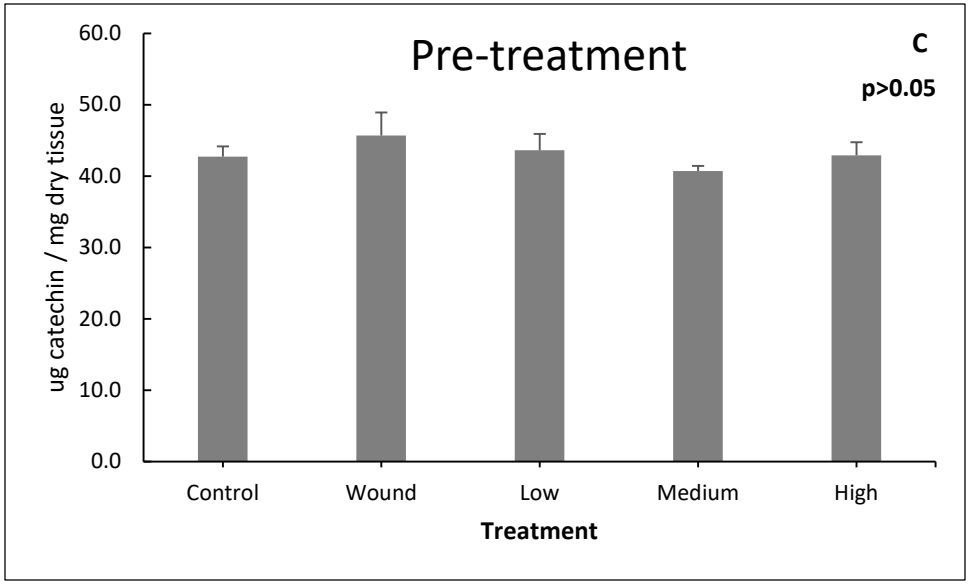
Lateral root of 30 yr old loblolly attacked by *Hylastes* spp.

Root collar of 6 yr old longleaf attacked by *Hylastes* spp.

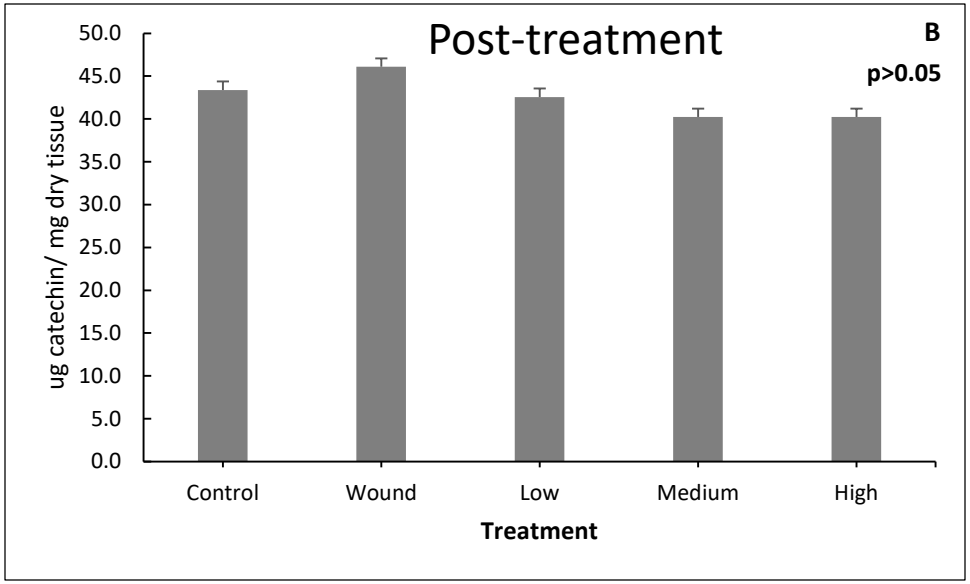


Results – Phenolics Induction

Pre-treatment total phenolic compounds

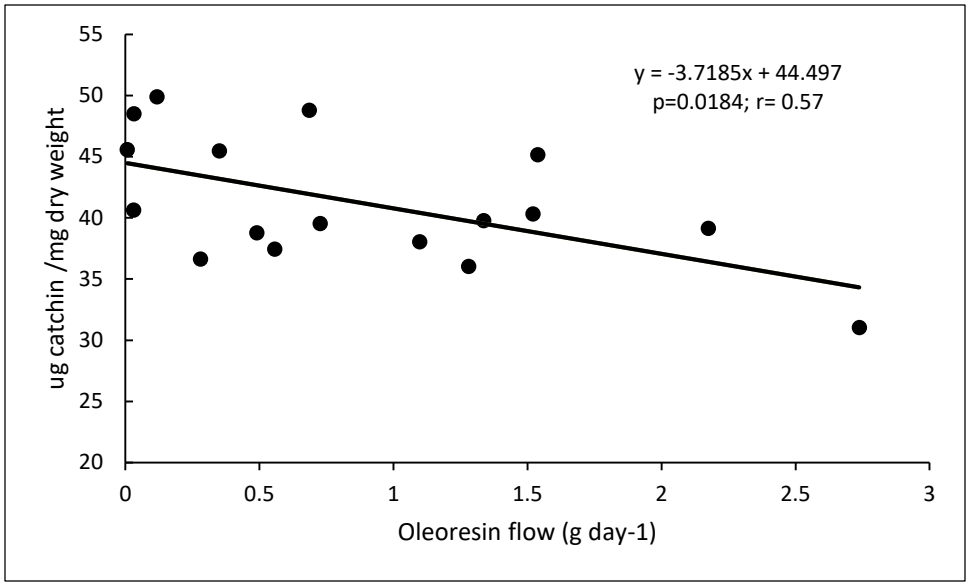


Induction of phenolic compounds following inoculation of loblolly pine with *L. terebrantis*

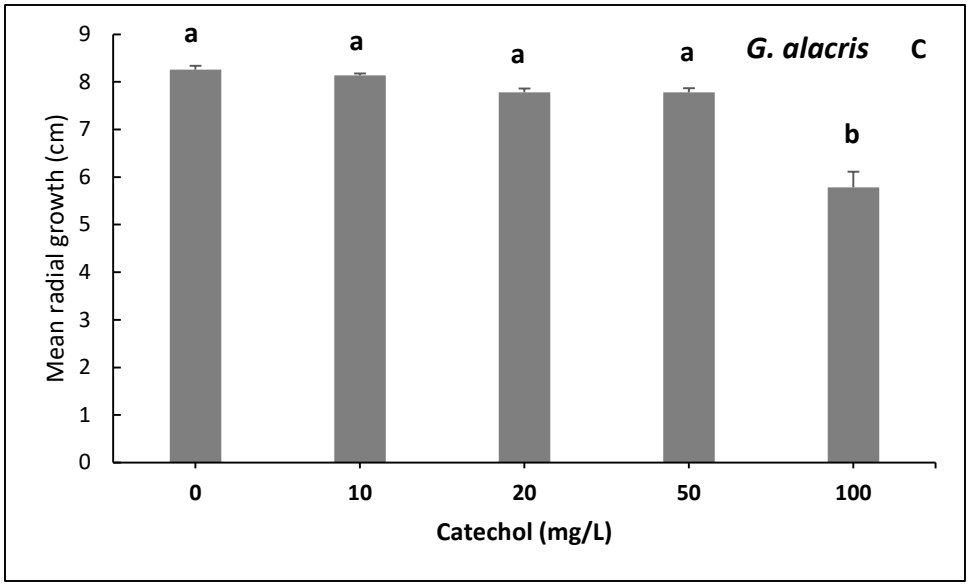


Results

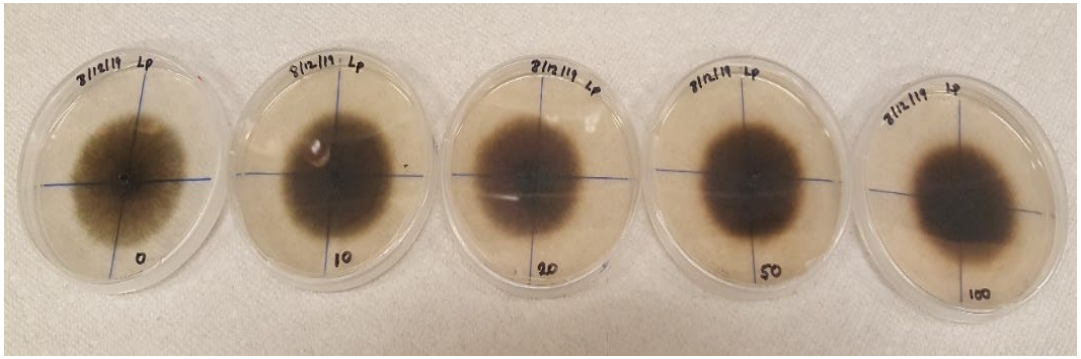
Relationship between total phenolics and oleoresins

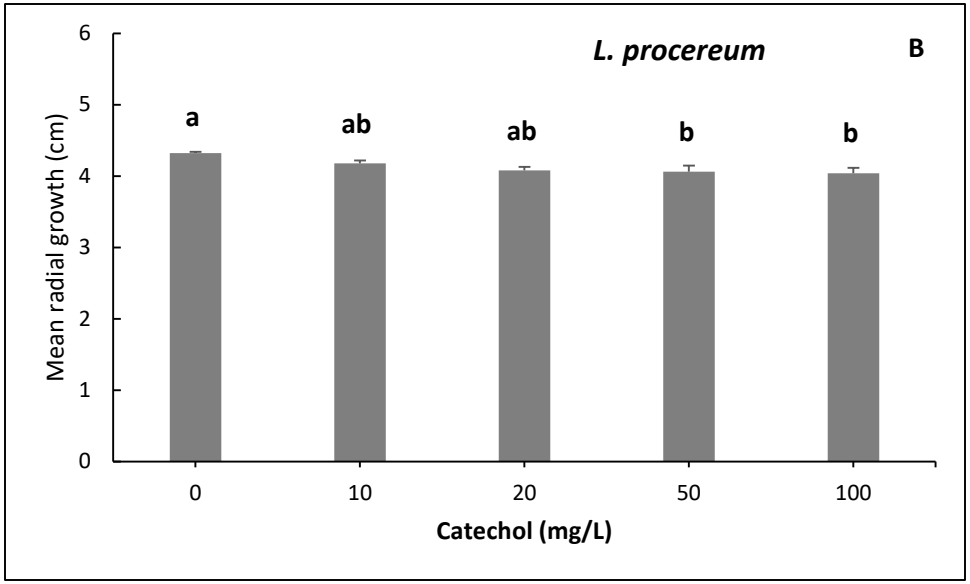


Growth of *G. alacris* on amended MEA



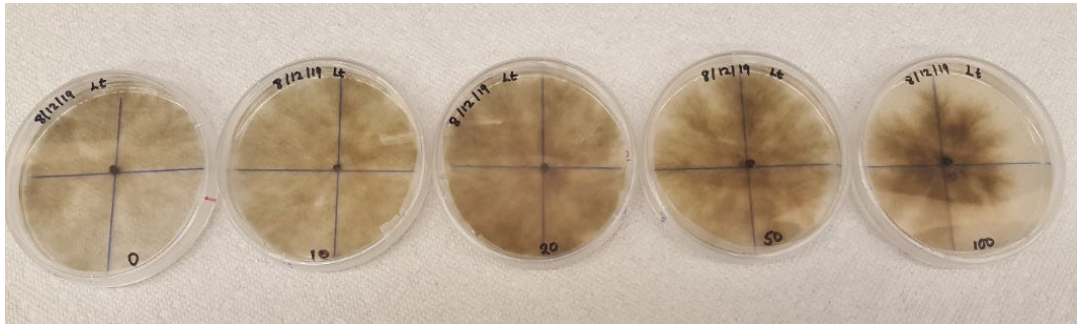
Results

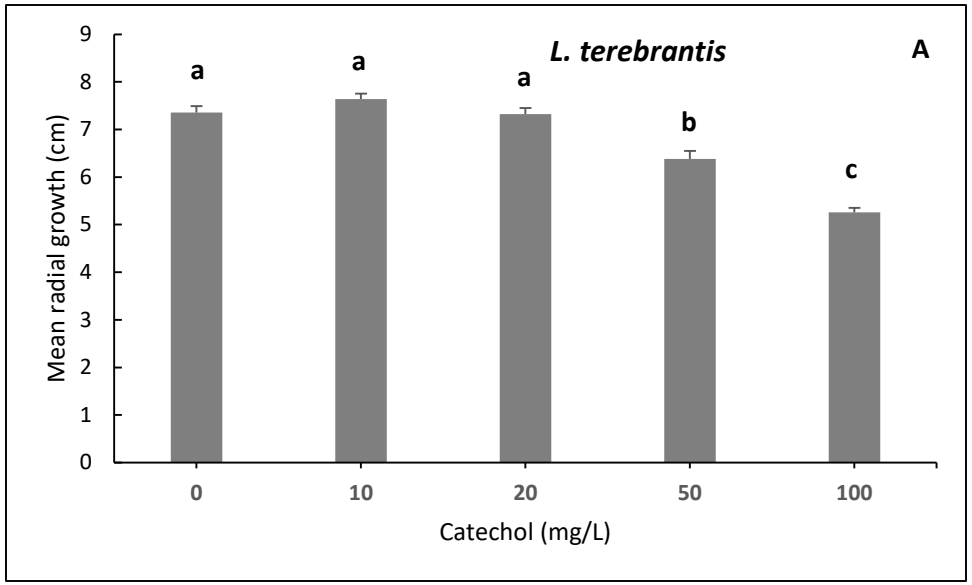




Radial growth of *L. procereum* on MEA amended with catechol at different concentrations

Results





Radial growth of *L. terebrantis* on MEA amended with catechol at different concentrations

Conclusions

The quantity of oleoresin induced by the fungal treatments was higher than either the wound or control treatment

The medium treatment trees produced more oleoresins relative to the high and low treatments

In contrast to the oleoresin, total phenolics did not differ prior to and post-treatment application but the quantity of phenolics produced decreased with fungal inoculum density

This suggests the potential degradation/utilization of phenolic compounds by *L. terebrantis*

L. terebrantis, L. procereum and *G. alacris* grew on MEA amended with different catechol concentrations indicating the ability of the fungi to utilize catechol as a source of carbon for growth

Future Work

Analysis of the oleoresins in phloem tissues to determine whether inoculum density and growth decline has the potential to alter the quality of the oleoresins

Acknowledgements

Dr. Lori G. Eckhardt
Dr. Emily A. Carter
Dr. Jeffrey Coleman
Dr. Mary A. Sword Sayer
Dr. Zhaofei Fan
Dr. Ryan Nadel
Dr. George Matusick

Tina Ciaramitaro
Sarah Peaden
Jessica Ahl
Charles Essien
Luis Mendez
Andrea Cole
Debit Datta
Pratima Devkota
Dalton Smith
Shrijana Duwadi
Sylvester Menanyih
Wharton Kristi
Undergraduate Students (Amelia Harrison & Jaliyl Collins)

Forest Health Cooperative