Antibacterial Activity of Native Plants in Arkansas

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Abstract

American beautyberry (*Callicarpa Americana*), Sugarberry (*Celtis laevigata*) and Red buckeye (*Aesculus pavia*) are native plants of Arkansas. Plant families with species having high chemical compounds can have antimicrobial properties. In this study, the antibacterial properties of the plants are investigated against three gram positive (*Bacillus cereus*, *Bacillus subtilis*, and Staphylococcus epidermidis) and three negative bacteria (Alcaligenes faecalis, Escherichia coli, and *Serratia marcescens*). The disc diffusion assay method is employed to identify any potential antibacterial properties of the plants. For this experiment, 6.41 g of dehydrated plant material (leaves for both species) was combined with 50 mL of 75% ethanol creating their respective tinctures which were processed to remove alcohol and make powder samples. The antibacterial activity of the powders in sterile Milli-Q water was tested against 75% ethanol and hydrogen peroxide controls. After 24 and 48 hours of incubation at 37° C the zones of inhibition were measured for each bacteria/plant sample combination. The three species of plant samples were tested for inhibition for the six bacteria. One-way ANOVA (analysis of variance) results showed that to examine the effect of different concentrations of plant samples and two different incubation times (24h and 48h) of each plant species on zones of inhibition for six different bacteria. Sugarberry and Red buckeye (leaves) showed antibacterial effects, however, the effect was less compared with commercial antibiotics (Erythromycin and NA30). American Beautyberry has an antibacterial effect comparable to commercial antibiotics. All species leaf extracts did not differ on their antibacterial properties on gram positive and gram-negative bacteria.

Introduction

- Many natural products from plants exhibit antimicrobial activity and are part of traditional healthcare in most parts of the world for thousands of years.
- Interest in plants as sources of agents to fight microbial diseases is increasing (Chariandy et al., 1999).
- Some groups of plants, especially relatives of highly used medicinal and aromatic plants, tend to have stronger antibacterial activity and a higher amount of quantitative and qualitative defensive chemicals than other lower plants (War et al. 2012).
- Red buckeye and Sugarberry are native plants of Arkansas well-known for used for various food and high chemical properties.
- American beautyberry is a native plant well-known for treatment of inflammation, rheumatism, nutrient-rich foods.

Research Purpose

To test antibacterial properties of two Arkansas native plant species, and to examine the phytochemical and biological aspects of the plant parts for those species.

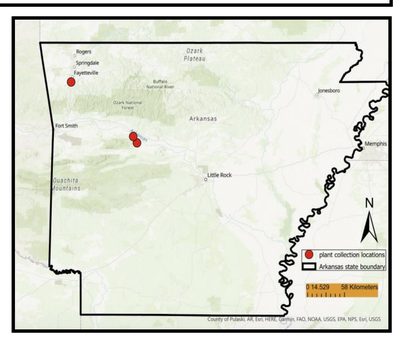


Figure 1- Plant collection locations- Mt. Nebo and Arkansas River Valley area nearby Russellville and in Ozark area

American Beauty Berry (*Callicarpa americana)*

Red buckeye (*Aesculus pavia*)

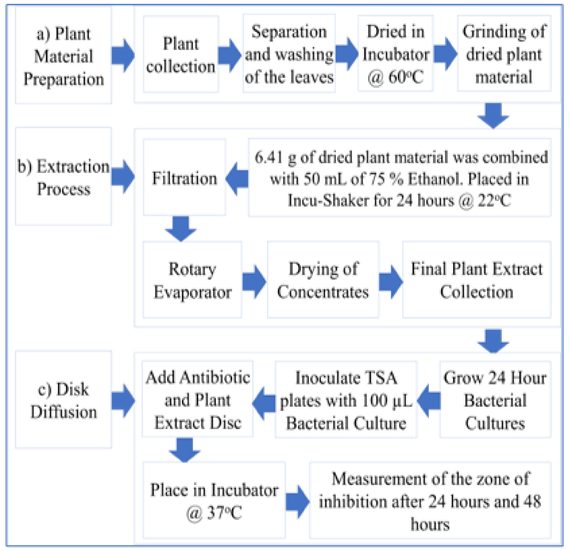
Sugarberry (*Celtis laevigata*)

Figure 2A. American Beauty Berry - Lamiaceae (Mint family) - A majority of Lamiaceae family species are high in aromatic and chemical compounds. Used for various medicines and high chemical properties.

Figure 2B. Red buckeye - *Sapindaceae* (soapberry family)- Small and medium sized trees- seeds are toxic in raw state.

Figure 2C. Sugarberry - *Cannabaceae* (Cannabis family) - A majority of *Cannabaceae* family species high in aromatic and chemical compounds. Used for various food and high chemical properties.

Methods



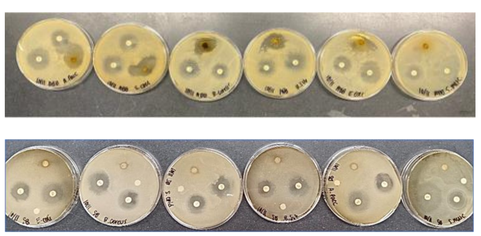
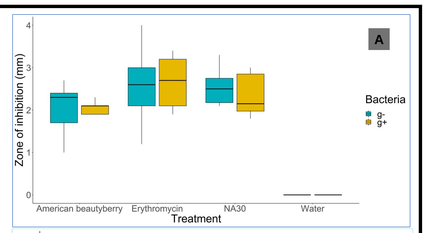
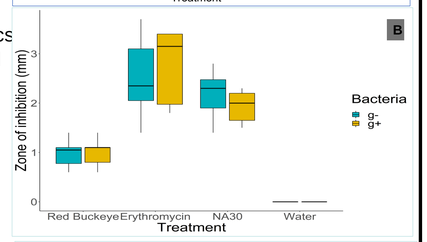


Figure 3.
(top) American Beauty Berry treatment effects on bacterial growth during experiment
(bottom) Sugarberry treatment effects on bacterial growth

Results

- Treatment (3 species leaf extracts, Erythromycin, NA30, Water) effect was analyzed on bacterial growth
- One-way ANOVA results showed that all three plant species have some antibacterial effects.
- American Beautyberry has antibacterial effect comparable to commercial antibiotics (Erythromycin and NA30) contrary to Red Buckeye and Sugarberry
- All species leaf extracts did not differ on their antibacterial properties on gram positive and gram-negative bacteria.





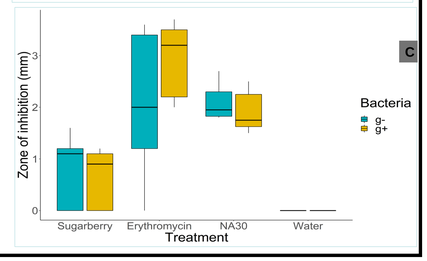


Figure 4. Box plots showing variation in zone of inhibition of different treatments for:
A. American Beauty Berry
B. Red Buckeye
C. Sugarberry

Implications

- Native plant species showed promising antibacterial properties.
- Antibacterial properties of bark, fruits, and seeds of all species are currently under study.
- We will also examine the phytochemical and biological properties of the plant extracts on all species in future.

References

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