

The Medicinal Value of Endophytes in *Prunus serotina*, the Wild Cherry Tree

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Abstract

The *Prunus serotina* otherwise known as the wild cherry tree has been used in herbal medicine for years. This research aimed to explore the connections between the isolated fungal endophytes of the tree with their potential medicinal uses.

Introduction

The *Prunus serotina* or the wild cherry tree has been used by many Native American tribes for medicine in the past. They used the bark of the root, trunk, and branches to treat many ailments by steeping it in hot water to create a medicinal sedative tonic. It was a cure all that treated sores, ulcers, eased the early pain in labor, and relieved inflammatory related symptoms such as colds, fevers, or sore throats. The cyanide in the leaves was also historically used to stimulate respiration, improve digestion, and has been beneficial towards the treatment of cancer. Lastly, the berries have been used to treat dysentery. There are fungal organisms that live within the *Prunus serotina* called endophytes. Endophytes are fungal organisms that live within plants for some of its life cycle and are responsible for responding to its environment. This study aims to look at these fungal endophytes for their medicinal purposes.



Experimental Design

Sample Collection / Plating:

- Samples of *Prunus serotina* were taken directly from the tree
- The stem was washed with bleach, ethyl acetate, and water and plated on PDA for endophyte growth

Extraction of Endophyte Metabolites:

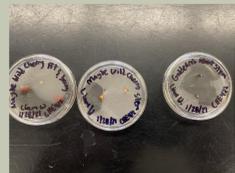
- Cuts from the plates were taken with a sterile knife and placed into potato dextrose broth
- The broth was left for weeks to grow and extract the metabolites into the broth.
- The metabolites were extracted out of the broth using separation funnels and ethyl acetate. Then roto-vaped.

Bioactivity / Inhibition of Bacteria:

- The extracted metabolites, broth, and sample solids were used to test the bioactivity in *E.coli*, *Pseudomonas*, *Staphylococcus*, and *Vibrio*.
- Measurements of the inhibitory rings were recorded.

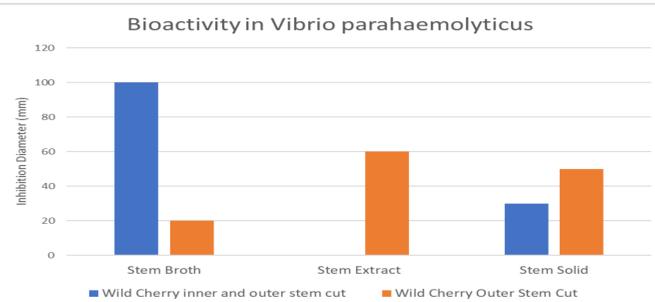
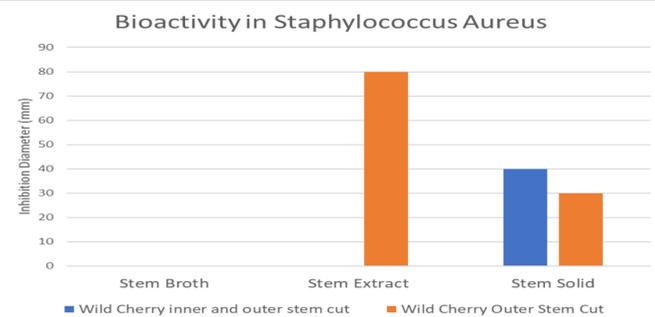
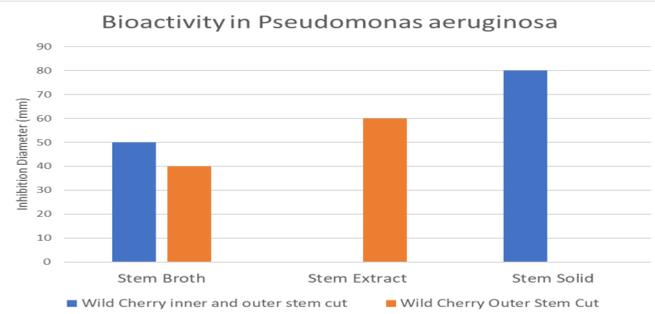
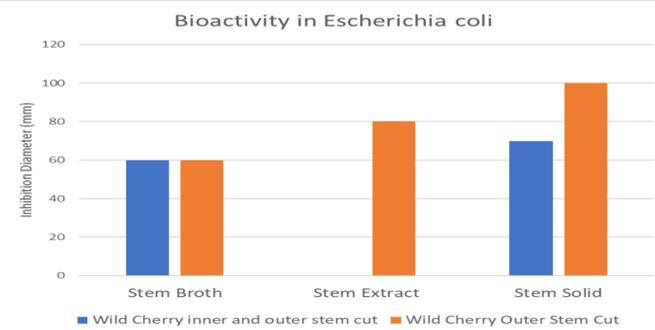
Identification of Metabolites Using UPLC-MS:

- The endophyte metabolites previously extracted were analyzed using LC-MS to find the medicinal compounds within.



Results / Figures

Inhibitory Graphs for Bacteria



LC-MS Results

Prunus serotina Medicinal Compounds: Cardiovascular

Common Name	Medicinal Uses	Samples	Structure
Guanabenz	used to treat high blood pressure. Guanabenz works by decreasing your heart rate and relaxing the blood vessels so that blood can flow more easily through the body	Outer stem cut	<chem>Cc1ccc(Cl)c(Cl)c1N=C(N)N</chem>
Taurine	Used to treat congestive heart failure, high blood pressure, high cholesterol, cystic fibrosis, and to prevent the buildup of plaque in the arteries throughout the body. Taurine occurs naturally in the human brain and can have anti-dementia properties.	Outer stem cut	<chem>CC(N)S(=O)(=O)N</chem>

Prunus serotina Medicinal Compounds: Neurological/Phycological

Common Name	Medicinal Uses	Samples	Structure
Kava	making you feel calm, relaxed, and happy. Is also thought to relieve pain, prevent seizures, and relax muscles.	Outer stem cut	<chem>CC1=CC=C(C=C1)C(=O)OC2=CC=CC=C2</chem>
Biotin	used for preventing and treating biotin deficiency associated with pregnancy, long-term tube feeding, malnutrition, and rapid weight loss. It is also used orally for hair loss, brittle nails, skin rash in infants (seborrheic dermatitis), diabetes, and mild depression. Has a role in the metabolism of E. Coli ⁴ .	Outer stem cut	<chem>CC1=CC=C(C=C1)C(=O)OC2=CC=CC=C2</chem>
Diazepam	used to treat anxiety, alcohol withdrawal, seizures, relieve muscle spasms, provide sedation before medical procedures, treatment of immobility associated with strains, sprains, and injuries of the back or injuries to the neck. Also used for the treatment of skeletal muscle hyperactivity that can occur in multiple sclerosis. Used as a central nervous system depressant used to induce drowsiness or sleep or to reduce psychological excitement or anxiety.	Outer stem cut	<chem>CN1C=NC2=C1C(=C(C=C2)C)C</chem>
Ropinirole	A drug that binds to and activates dopamine receptors. A drug used in the treatment of Parkinson's disease.	Outer stem cut	<chem>CCN1C=NC2=C1C(=C(C=C2)C)C</chem>

Prunus serotina Medicinal Compounds: Antibiotics/Anesthesia/Muscle Relaxers

Common Name	Medicinal Uses	Samples	Structure
sulfacetamide	is used to treat bacterial eye infections (such as conjunctivitis). It belongs to a class of drugs known as sulfa antibiotics. Sulfacetamide works by stopping the growth of bacteria. Also works to treat dandruff and bacterial skin infections.	Outer stem cut	<chem>CC(=O)Nc1ccc(S(=O)(=O)N)cc1</chem>
Ohmefentanyl	This is an extremely potent opioid analgesic drug which selectively binds to the μ -opioid receptor. It can be used for anesthesia, but it has been recorded as having a potency that is 6,300 times morphine.	Outer stem cut	<chem>CC1=CC=C(C=C1)C(=O)OC2=CC=CC=C2</chem>
Ampicillin	Ampicillin is a beta-lactam penicillin antibiotic with bactericidal activity. Ampicillin can be used in wide range of gram-positive and -negative infections.	Outer stem cut	<chem>CC1=CC=C(C=C1)C(=O)OC2=CC=CC=C2</chem>
propylthiouracil	used to treat hyperthyroidism in adults and children 6 years of age or older. Propylthiouracil is in a class of medications called antithyroid agents.	Outer stem cut	<chem>CC1=CC=C(C=C1)C(=O)OC2=CC=CC=C2</chem>

Prunus serotina Medicinal Compounds: Antihistamines/Respiratory

Common Name	Medicinal Uses	Samples	Structure
Cetirizine	treat hay fever and allergy symptoms, hives, and itching.	Outer stem cut Inner and outer stem cut	<chem>CC1=CC=C(C=C1)C(=O)OC2=CC=CC=C2</chem>
Doxylamine	It can treat hay fever and other allergy symptoms	Outer stem cut	<chem>CC1=CC=C(C=C1)C(=O)OC2=CC=CC=C2</chem>
Cortisone Acetate	treats many conditions such as allergic disorders, skin conditions, ulcerative colitis, arthritis, lupus, psoriasis, or breathing disorders	Outer stem cut	<chem>CC(=O)OC1=CC=C(C=C1)C(=O)OC2=CC=CC=C2</chem>
Beclomethasone	used in the long-term management of asthma, may be used for dermatitis and psoriasis	Outer stem cut	<chem>CC1=CC=C(C=C1)C(=O)OC2=CC=CC=C2</chem>
L-(-)-Menthol	A drug, usually applied topically, that relieves pruritus (itching). Has a connection to the metabolism of E.Coli ³	Outer stem cut Inner and outer stem cut	<chem>CC1=CC=C(C=C1)C(=O)OC2=CC=CC=C2</chem>

Prunus serotina Other Compounds of Interest

Common Name	Medicinal Uses	Samples	Structure
Calcium acetate	used to control high blood levels of phosphorus in people with kidney disease who are on dialysis	Outer stem cut	<chem>CC(=O)OC1=CC=C(C=C1)C(=O)OC2=CC=CC=C2</chem>
cis-Diethylstilbestrol	inhibits the hypothalamic-pituitary-gonadal axis, thereby blocking the testicular synthesis of testosterone, lowering plasma testosterone, and inducing a chemical castration. Estrogen.	Outer stem cut	<chem>CC1=CC=C(C=C1)C(=O)OC2=CC=CC=C2</chem>
2-(Sec-butyl)thiazole	used to color foods and enhance tomato based products flavor, and other savory flavor condiments	Outer stem cut Inner and outer stem cut	<chem>CC1=CC=C(C=C1)C(=O)OC2=CC=CC=C2</chem>
D-(-)-Tartaric acid	have a plethora of uses in the field of pharmaceuticals. For example, it has been used in the production of effervescent salts, in combination with citric acid, to improve the taste of oral medications. Also has a role in E.coli metabolism.	Outer stem cut	<chem>OC(O)C(O)C(O)C(O)O</chem>
Sorafenib	used in antineoplastic agent, a substance that inhibits or prevents the proliferation of neoplasms. (anti cancer) Specifically the treatment of solid tumors, advanced RCC, and improve survivability in patients with advanced HCC.	Outer stem cut	<chem>CC1=CC=C(C=C1)C(=O)OC2=CC=CC=C2</chem>

Discussion and Conclusion

The research conducted on *Prunus serotina* over the years is largely supported by the compounds found in the LC-MS. For instance, research on the anti-proliferative effects of the wild cherry bark extracts on the human colorectal cancer cells could be due to the sorafenib found in the outer stem cut samples⁴. Another similarity drawn is between the research on the *Prunus serotina* and its richness in polyphenols to help improve cardiovascular risk reduction, this may be due to the Guanabenz or Taurine from the outer stem cut sample^{2,3}. The anti-inflammatory contents of the plant investigated by Blanca Rivero-Cruz could be due to cetirizine or doxylamine¹. Another article details the antidiabetic nature of the tree which could be due to the biotin found in the outer stem cut, which has a known role in the metabolism of *E. coli*^{5,7}.

Overall, this research has uncovered new potential uses for the tree *Prunus serotina*. Compounds used to treat anxiety, multiple sclerosis, renal cell carcinoma, hepato cellular carcinoma, and Parkinson's disease were found in the endophytes and were not previously listed in the literature.

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