

INTRODUCTION

- Plants growing in a field could be native, non-native, or invasive. A native plant has existed in a specific region for a long time, adapting to the climate.
- Fields are often disturbed by human activities like agriculture such as contaminated farm equipment and animal feed, or seeds on vehicles coming in, which can lead to non-native plants.
- Invasive plants are introduced through human activity.
- Many plants growing in fields have antimicrobial properties, which they use as a natural defense against bacteria.
- Plants produce antimicrobial properties that act as their defense mechanism against pests or predators. They also act as a natural barrier that inhibits the growth of bacteria that could be harmful.

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PURPOSE/HYPOTHESIS

- The purpose of this project is to determine whether plants grown in an open field have antimicrobial properties, and if so how do they compare to common antibiotics. Bacteria used for testing will be *Escherichia coli* (k12), a gram negative rod, and *Staphylococcus epidermidis*, a gram positive cocci.
- It is hypothesized that selected plants from a field could have antimicrobial properties. It is further hypothesized that if the plants show antimicrobial properties they will not be as effective as common antibiotics.

VARIABLES

Independent: Different plant species

Dependent: Antibacterial properties (size of zones of inhibition)

Control: Water Only on the blank disks used for Kirby Bauer Test

PROCEDURE

Preparing extract of plants

Weight out 1g of each leaf and place into beakers with 25mL of distilled water.

Bring to a boil, then turn down heat to medium and lightly boil for 5 minutes.

Using a mesh strainer, strain liquid off and place in sterile containers with lids.

Photos Taken by Locklyn Ward, 2026

Kirby Bauer Sensitivity Test

1. Using a sterile cotton swab, dip into bacterial broth from stock culture to tryptic soy broth (nutrient broth) to get culture to log phase of reproduction.
2. Using a sterile cotton swab, transfer bacteria to Mueller-Hinton agar plates.
3. Dip sterile paper disks halfway into testing solutions (plant extracts) and let transfer to top of disk by capillary action.
4. Place disks onto a paper towel to drain.
5. Transfer disks to Mueller-Hinton agar plates containing bacteria.
6. Repeat for all testing substances.
7. Incubate plates at 37 degrees Celsius for 24 hours.
8. Remove and measure the diameter of the clear zone (zone of inhibition). The disk itself measures 6mm, so that would indicate resistance to bacteria.

A Study of Open Field Plants, Native and Non-Native, and Their Antimicrobial Properties Against *Escherichia coli* and *Staphylococcus epidermidis*

DATA TABLES/ GRAPHS

Leaf Extracts Against <i>E. coli</i> - Zone of Inhibition				
	Trial 1	Trial 2	Trial 3	Average
Thorny Red Careless	6	6	6	6
Black Walnut	6	6	6	6
Bitter Sneeze Weed	6	6	6	6
Johnson Grass	6	6	6	6
Mare's Tail	6	6	6	6
Japanese Clover	6	6	6	6
Passion Flower	20	19	22	20
Fox Tail	13	16	17	15
Native Pecan	6	6	6	6
Ragweed	6	6	6	6
Poke	15	15	16	15
Persimmon	10	10	12	11
Marigold	11	12	10	11
Golden Rain Tree	9	8	8	8
Flowering Almond Shrub	11	9	9	10
Bull Nettle	6	6	6	6
Grapevine	15	14	16	15
Horseweed	6	6	6	6
Mullein	6	6	6	6
Purple Mintweed	10	10	11	10
Dandelion	14	15	15	15
Milkweed	6	6	6	6
Bermuda	6	6	6	6
Hedge Apple	12	13	12	12
Ampicillin	20	20	22	21
Ciprofloxacin	32	30	30	31
Septra	24	22	24	23

* 6mm is the size of the paper disk, therefore 6mm indicates a negative result for antimicrobial activity

Data table and Graph #1 created by Locklyn Ward in Google Sheets, 2026.

Plant - Zones of Inhibition Against *E. coli*

Plant	Zone of Inhibition (mm)
Passion Flower	20
Fox Tail	15
Poke	15
Persimmon	11
Marigold	11
Golden Rain Tree	8
Flowering Almond Shrub	10
Grapevine	15
Purple Mintweed	10
Dandelion	15
Hedge Apple	12
Ampicillin	21
Ciprofloxacin	31
Septra	23

Data table #3 created by Locklyn Ward on Google Sheets, 2026.

Nativity Status				
	Native	Non-Native	Invasive	Antimicrobial
Thorny Red Careless			X	
Black Walnut	X			X SE
Bitter Sneeze Weed	X			
Johnson Grass		X	X	
Mare's Tail	X			
Japanese Clover		X		
Passion Flower		X		X EC
Fox Tail		X	X	X EC/SE
Native Pecan	X			
Ragweed	X			
Poke	X			X EC
Persimmon	X			X EC/SE
Marigold	X			X EC/SE
Golden Rain Tree		X		X EC
lowering Almond Shrub		X		
Bull Nettle	X			
Grapevine	X	X		X SE
Horseweed	X			
Mullein		X		
Purple Mintweed		X		X SE
Dandelion		X		X EC/SE
Milkweed	X			X SE
Bermuda		X		
Hedge Apple	X			X SE

EC = *Escherichia coli* SE = *Staphylococcus epidermidis*

Leaf Extracts Against <i>S. epidermidis</i> - Zone of Inhibition				
	Trial 1	Trial 2	Trial 3	Average
Thorny Red Careless	6	6	6	6
Black Walnut	9	9	10	9
Bitter Sneeze Weed	6	6	6	6
Johnson Grass	6	6	6	6
Mare's Tail	6	6	6	6
Japanese Clover	6	6	6	6
Passion Flower	6	6	6	6
Fox Tail	10	10	11	10
Native Pecan	6	6	6	6
Ragweed	6	6	6	6
Poke	6	6	6	6
Persimmon	12	12	11	12
Marigold	10	8	8	9
Golden Rain Tree	6	6	6	6
Flowering Almond Shrub	6	6	6	6
Bull Nettle	6	6	6	6
Grapevine	12	12	14	13
Horseweed	6	6	6	6
Mullein	6	6	6	6
Purple Mintweed	6	6	6	6
Dandelion	12	12	12	12
Milkweed	10	10	8	9
Bermuda	6	6	6	6
Hedge Apple	10	11	11	11
Ampicillin	18	18	16	17
Tetracycline	26	24	24	25

* 6mm is the size of the paper disk, therefore 6mm indicates a negative result for antimicrobial activity

Data table and Graph #2 created by Locklyn Ward in Google Sheets, 2026.

Plants - Zones of Inhibition Against *Staph epidermidis*

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CONCLUSION and Applications

- The hypothesis that selected plants from a field could have antimicrobial properties was accepted.
- Fifty four percent of the plants had antibacterial properties against bacteria.
- The hypothesis that if the plants show antimicrobial properties they would not be as effective as common antibiotics was also supported.
- All zones of inhibition were below the antibiotic zone sizes.
- Herbal applications over antibiotics could shine for mild recurring infections and may offer synergistic properties.
- The best use would be under guidance, and could be used for prevention of antibiotic resistance.

FUTURE RESEARCH

- Plants could be extracted by infusion using ethanol, or oil
- Plants could be extracted through roots
- Plants could be extracted by steam distillation, capturing volatile chemical
- Test commercial flowers vs open field
- Test more strains of bacteria using Kirby Bauer Test
- Test plants during spring, summer and fall to determine whether temperatures effect antibacterial properties

ABSTRACT

With the overuse of so many Americans using antibiotics, alternative treatments are always being researched. Many herbs are used which are made from plants. I live on a farm outside of Grove, OK, and wondered if there were plants growing in the field that might have antimicrobial (killing bacteria) properties. The purpose of this project is to determine whether plants grown in a field have antimicrobial properties, and if so how do they compare to common antibiotics. It is hypothesized that selected plants from a field could have antimicrobial properties. It is further hypothesized that if the plants show antimicrobial properties they will not be as effective as common antibiotics. Plants were picked and identified in the field. The plants were weighed to 1g, then placed into 25mL of distilled water. The plants were extracted by heat, then drained and placed into sterile containers with lids. A Kirby Bauer Sensitivity Test was performed on all plant solutions using *E. coli* (k12) and *Staph epidermidis*. In conclusion, the hypothesis that selected plants from a field could have antimicrobial properties was accepted. Fifty four percent of the plants had antibacterial properties against bacteria. The hypothesis that if the plants show antimicrobial properties they would not be as effective as common antibiotics was also supported. All zones of inhibition were below the antibiotic zone sizes.

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