

Antimicrobial Properties of Exotic Chili Peppers Against Common Food Pathogens



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Background

▶ Microorganisms are responsible for causing food spoilage and a number of different foodborne illnesses each year



▶ Illnesses can range from gastrointestinal discomfort to spontaneous abortions in pregnant women, and can even result in death in severe cases

▶ Some varieties of chili peppers have been found to possess antimicrobial properties, with activity levels equivalent to that of some modern day antibiotics

▶ Exotic species have never been tested

Study Objective

Determine the antimicrobial properties of 9 exotic *Capsicum* species (fruit and/or leaves) against major food pathogens, including *Listeria monocytogenes*, *Escherichia coli* O157:H7, and *Staphylococcus aureus*

Methods

- ▶ Targeted hot pepper varieties
- ▶ Extracted leaf/fruit samples and prepared pepper samples at two dilutions (1:5 and 1:10)
- ▶ Growth Inhibition Assay – 18 hours
 - How well the extract prevents growth of the microorganism
 - Measures optical density to indicate the concentration of microorganisms
- ▶ Resazurin Assay – 2 hours
 - How well the extract kills an already thriving microorganism
 - Electrons from respiring (living) organisms reduce resazurin dye from blue to pink

Pepper Varieties

* Scoville heat units



Tobasco
30,000 SHU*



CGN 22795
(SHU N/A)



Aji Chiapita
(SHU N/A)



Red Rocoto
317 SHU



Aji Crystal
130,000 SHU



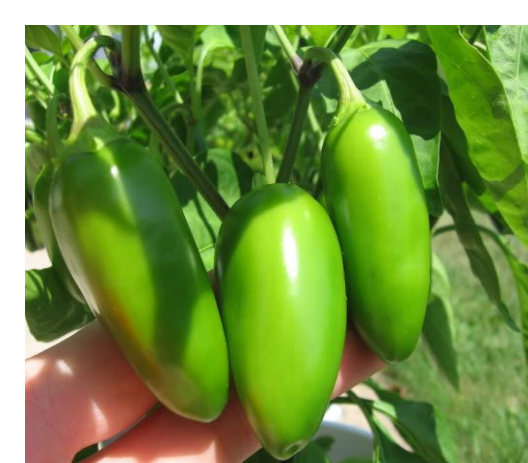
Chocolate Habanero
480,000 SHU



CAP 691
(SHU N/A)



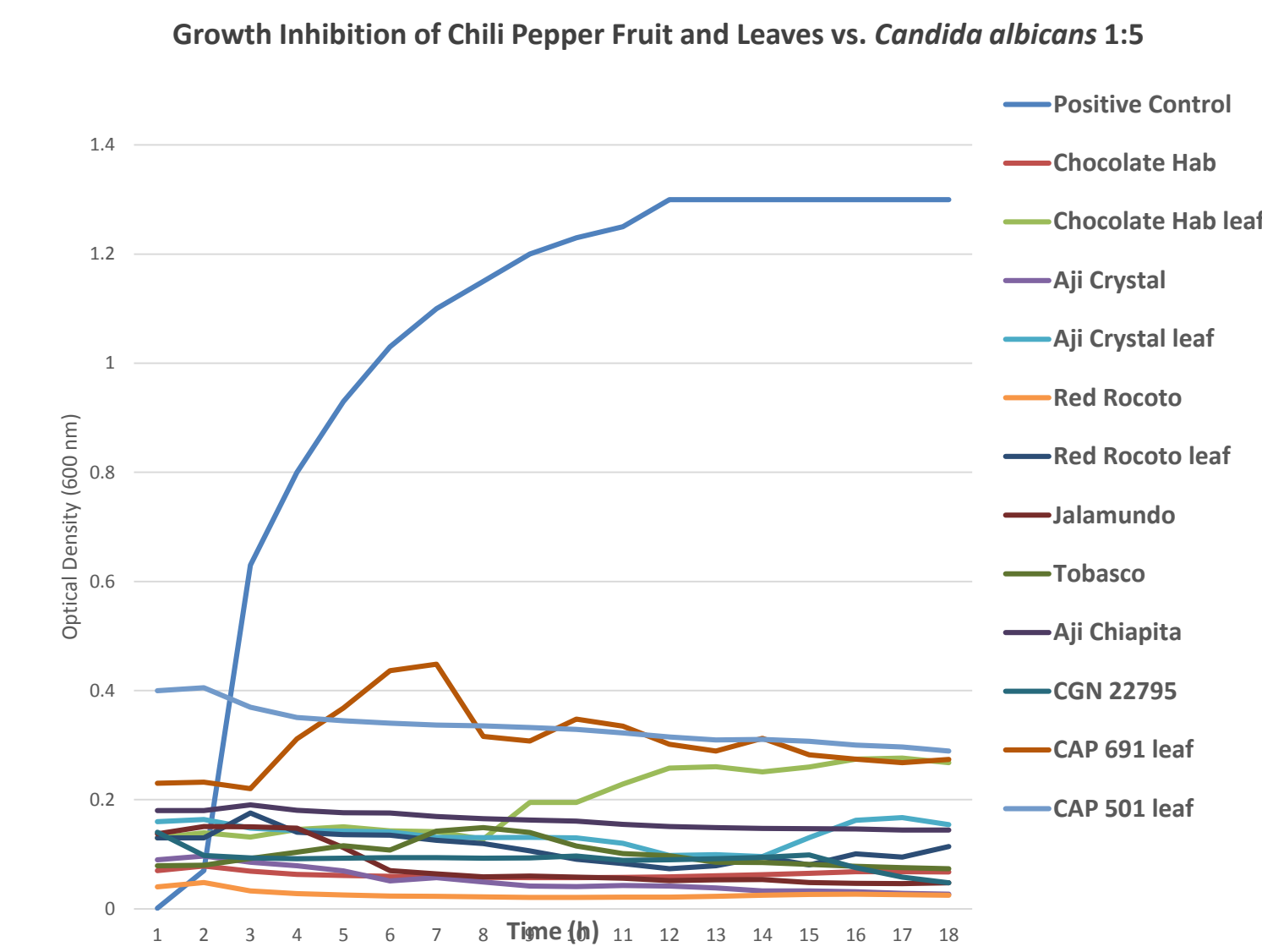
CAP 501
(SHU N/A)



Jalamundo
107,000 SHU

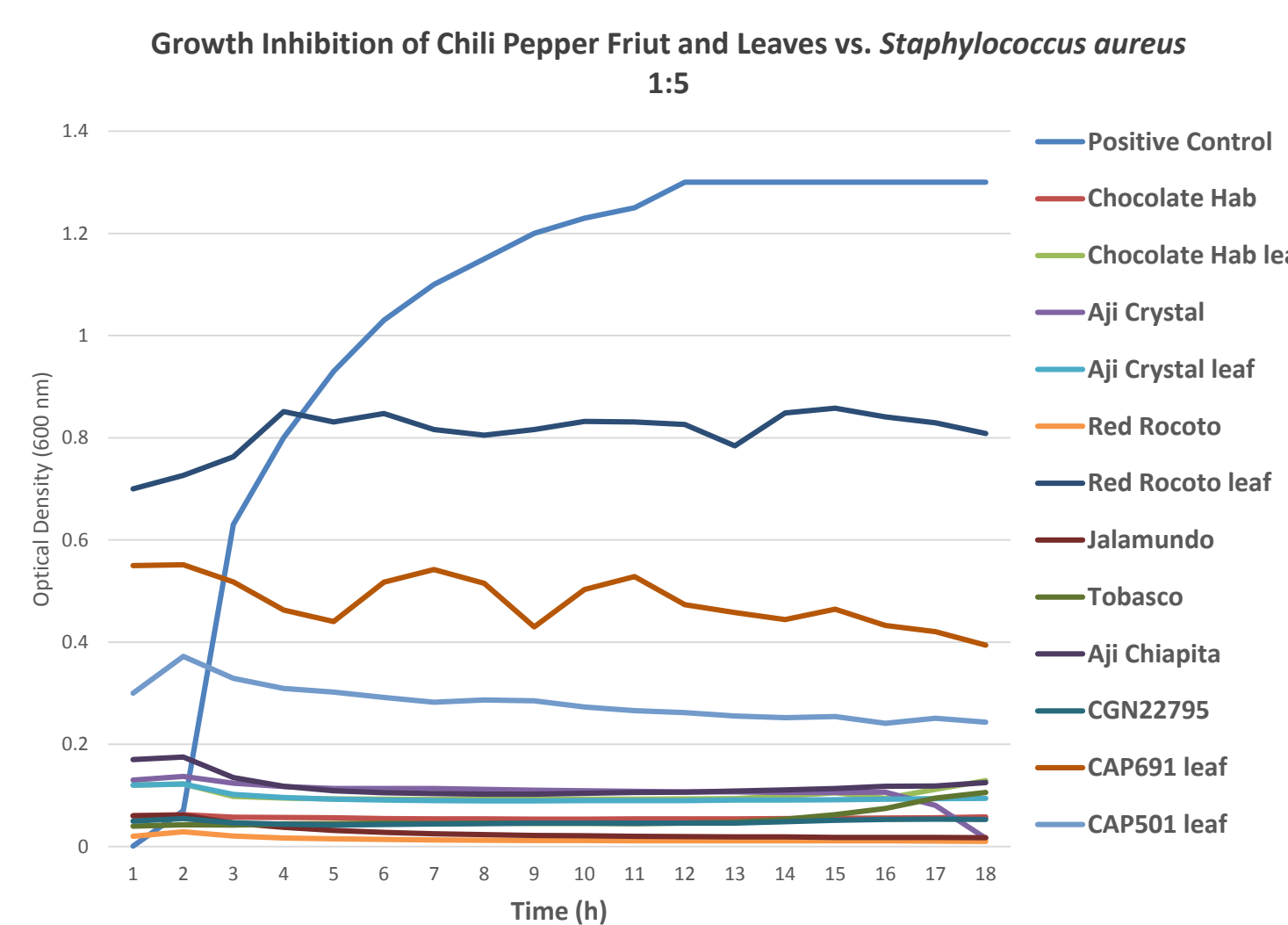
Results: Growth Inhibition Assay

Candida albicans



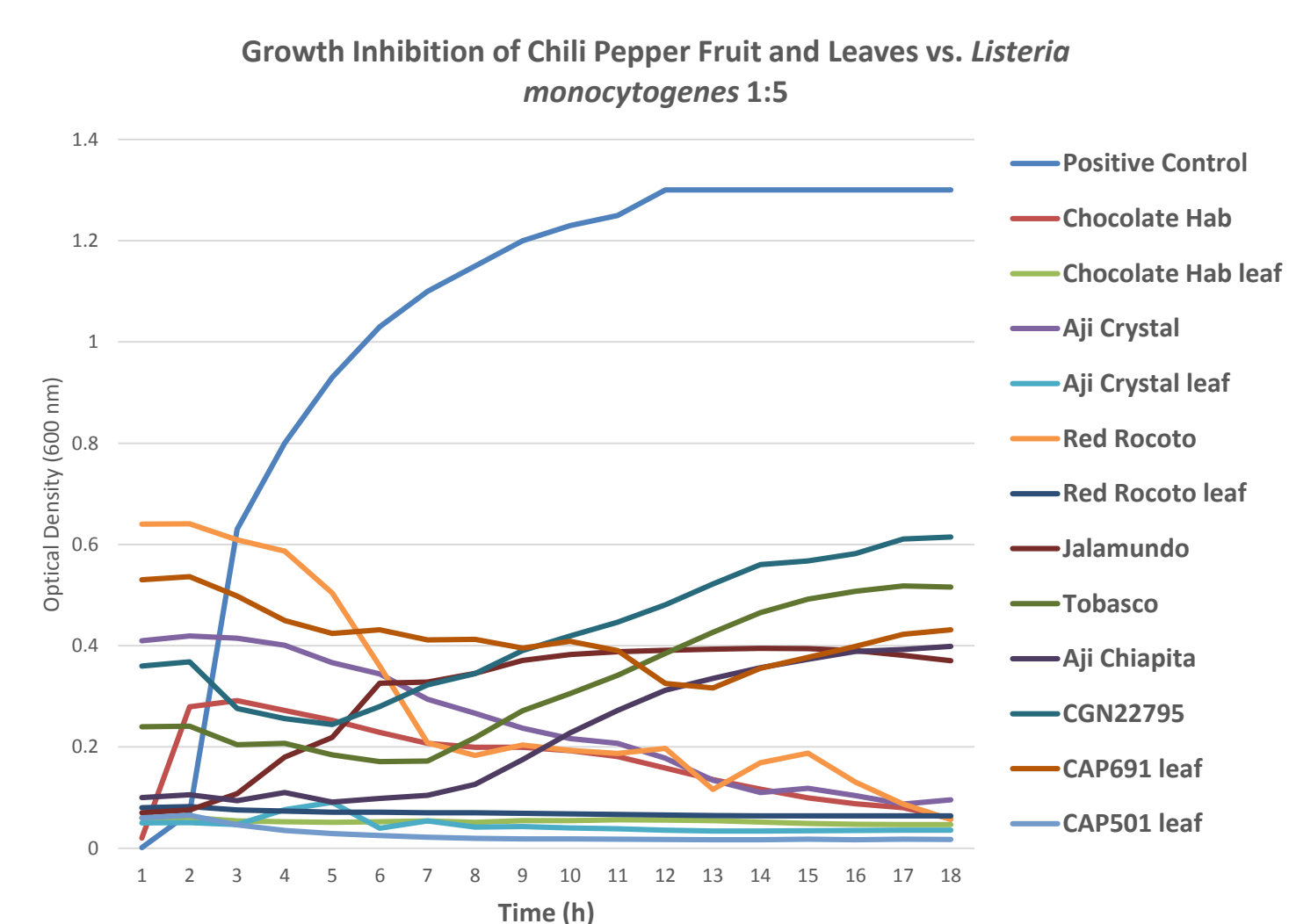
▶ All *Capsicum* species inhibited the growth of *Candida albicans* at a 1:5 dilution except Chocolate Habanero leaves and Aji Crystal leaves

Staphylococcus aureus



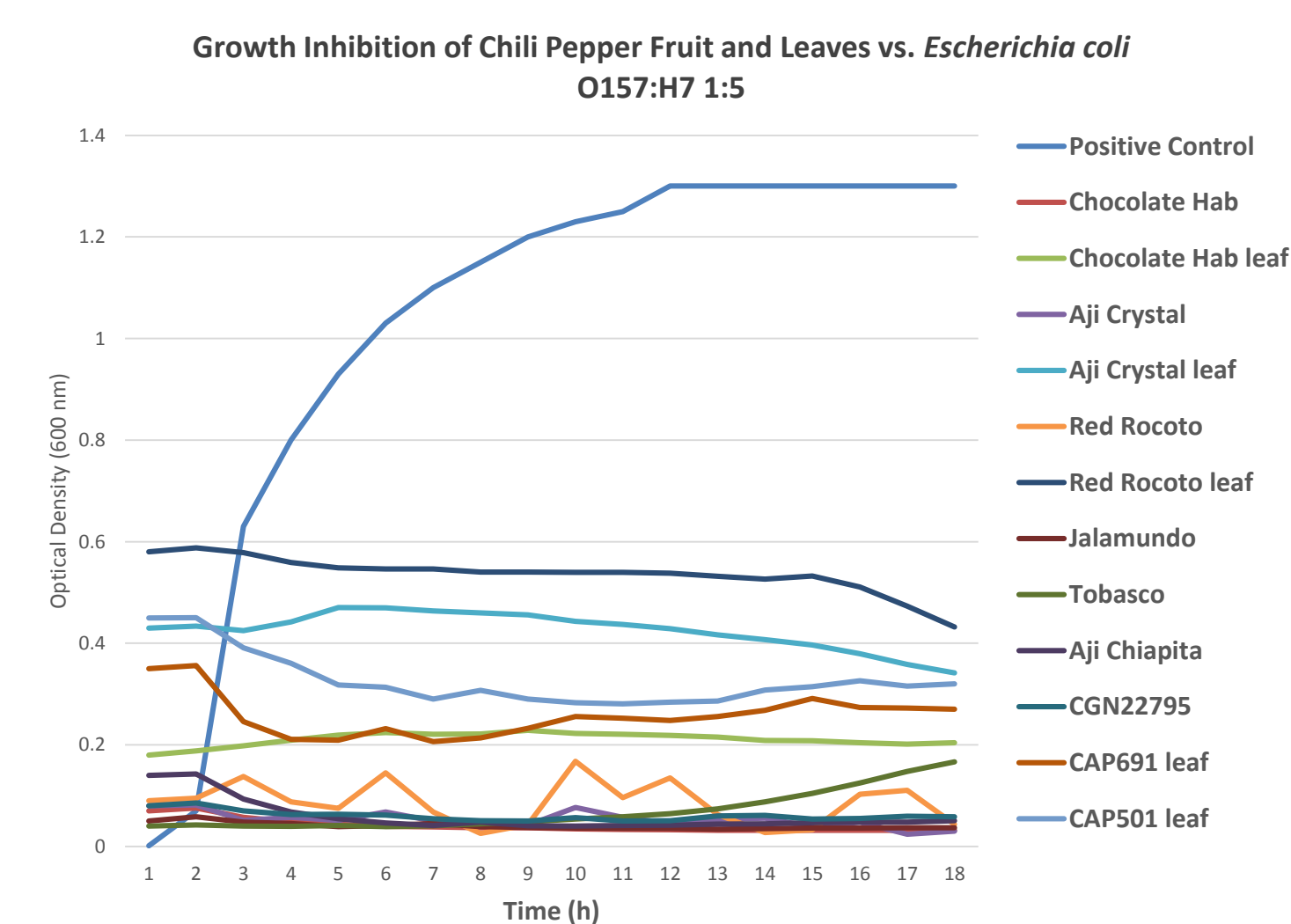
▶ All *Capsicum* species inhibited the growth of *Staphylococcus aureus* at a 1:5 dilution except Tobasco fruit and Red Rocoto leaves

Listeria monocytogenes



▶ All *Capsicum* species inhibited the growth of *Listeria monocytogenes* at a 1:5 dilution except CGN 22795, Tobasco fruit, and Jalamundo fruit

Escherichia coli O157:H7



▶ All *Capsicum* species inhibited the growth of *Escherichia coli* O157:H7 at a 1:5 dilution except Tobasco fruit and Chocolate Habanero leaves

Results: Resazurin Assay

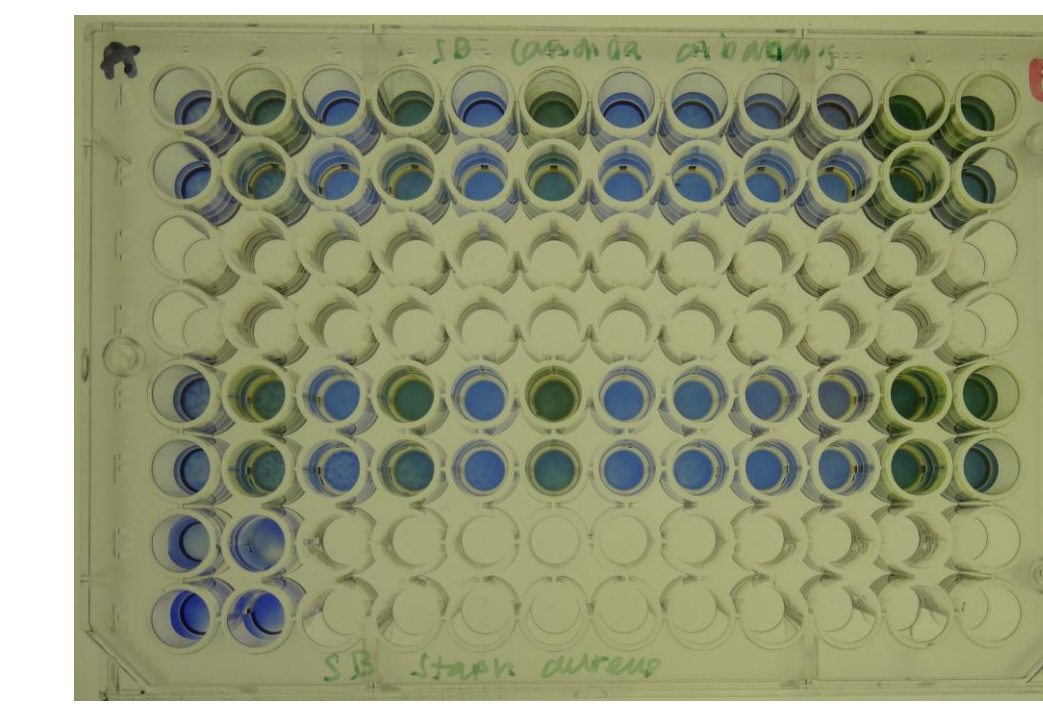


Plate A – Initial (Time 0)

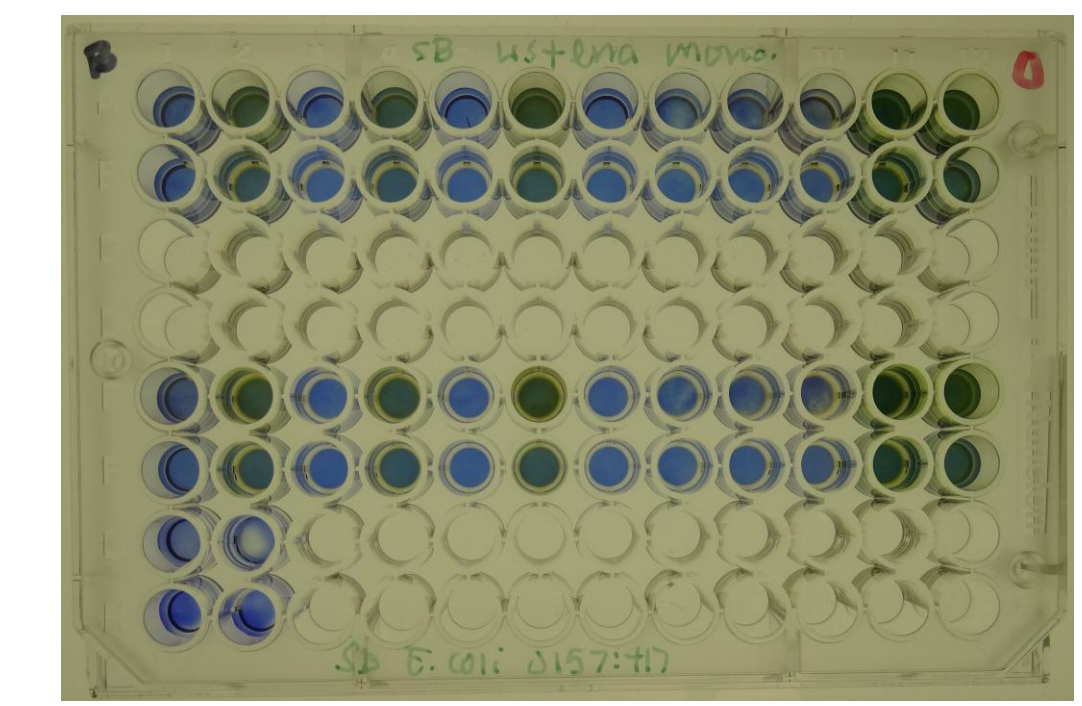


Plate B – Initial (Time 0)

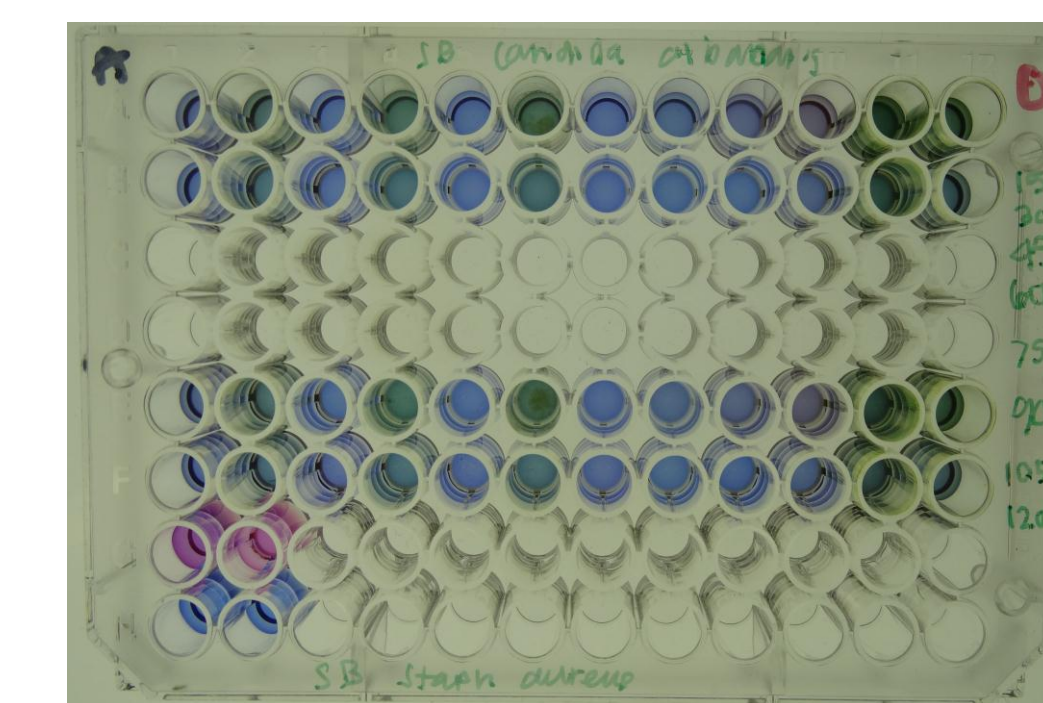


Plate A – After 2 hours

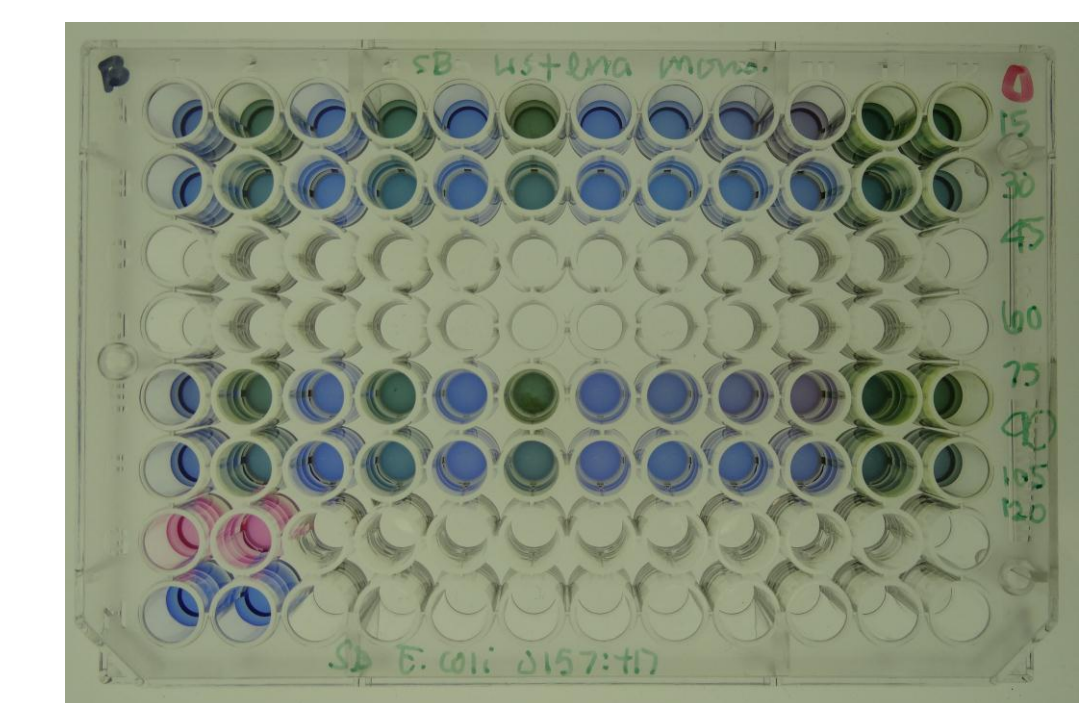


Plate B – After 2 hours

▶ According to the Resazurin Assay, all *Capsicum* species were effective at killing all of the four tested microorganisms

Discussion

- ▶ Inhibition of microorganisms varied among chili pepper species and among type (fruit vs. leaves)
- ▶ In general, fruits were more effective than leaves at inhibiting the growth of microorganisms tested
- ▶ Tobasco fruit showed to be a poor inhibitor of all bacteria tested
- ▶ All species showed to be effective at killing microorganisms tested
- ▶ Further research should explore greater dilutions to find the minimum amount of extract necessary to inhibit and/or kill pathogenic microorganisms commonly found in food
- ▶ Further research of exotic chili pepper species should also measure the capsaicin levels to understand if heat corresponds to antimicrobial ability

Acknowledgments

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References

1. Cichewicz RH, Thorpe PA. 1996. The antimicrobial properties of chile peppers (*Capsicum* species) and their use in Mayan medicine. *J Ethnopharmacol*, 52(2):61-70.
2. Lidia Dorantes et al. 2000. Inhibition of growth of some foodborne pathogenic bacteria by *Capsicum* annum extracts. *J Food Microbiol*, 57(2):125-8.
3. Jones NL, Shabib S, Sherman PM. 1997. Capsaicin as an inhibitor of the growth of the gastric pathogen *Helicobacter pylori*. *FEMS Microbiol Lett*, 15;146(2):223-7.