Drought Stress Shifts the Exometabolome Profile of Leaves in Juvenile Kale and Affects *Salmonella enterica* Growth in Leaf Exudates

Xingchen Liu[1], Yue Li, Shirley A. Micallef[1,2]*

[1]Department of Plant Science and Landscape Architecture, University of Maryland, College Park, MD 20742
[2]Centre for Food Safety and Security Systems, University of Maryland, College Park, MD 20742

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INTRODUCTION

- ***Salmonella enterica*** **can survive epiphytically, utilizing compounds released and exuded to plant surfaces, thus causing foodborne illnesses associated with leafy greens. Kale is increasing in popularity among American customers.**
- **A negative correlation was detected between higher proportions of certain specialized (secondary) metabolites and *Salmonella* levels on tomato surfaces (Han & Micallef, 2016).**
- **When crops experience water stress in hot weather, during dry spells and in between irrigation, they are likely to accumulate more specialized compounds such as phenolics and other antioxidant compounds (Myung et al., 2010). Plant development also affects accumulation of antioxidant compounds.**
- **The varied composition of plant specialized compounds leads the change to plant exo-metabolome, thus affecting pathogens associated with it.**

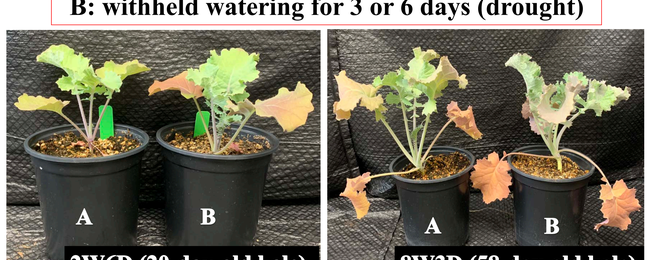
HYPOTHESIS

- **Developing kale plants, and kale under mild water stress will accumulate more secondary metabolites such as phenolics and exudes more into the their surface that inhibit the growth of *Salmonella enterica*.**

EXPERIMENTAL PLANS

Brassica napus **(Improved dwarf Siberian Kale)**

Separate 2 or 8 weeks old kale plants randomly into two treatments:
A: regular watering (control)
B: withheld watering for 3 or 6 days (drought)



EXPERIMENTAL PLANS

Both regularly watered and drought-exposed kale plants under the same age then separated into two groups for exudate collection by immersing all kale leaves in 5% methanol and shaking at 150 rpm for 24 hours.

Separate exudates into two groups:
INO: *Salmonella* inoculation in leaf washes;
ESI-MS: analysis of lyophilized washes

INO

S. **Newport was retrieved in exudate washes after 24 hours**

↓

Serial dilutions were plated onto TSA amended with rifampicin for enumeration and data analysis

ESI-MS

Lyophilized washes were analyzed through ESI-MS.

↓

ESI-MS profiles under both negative and positive modes were then analyzed through MDS

RESEARCH RESULTS

- **In kale exudate washes, regardless of age, the populations of *Salmonella* were significantly higher in regularly watered plants washes than in drought-exposed washes ($p<0.05$). The growth of *Salmonella* in 20-day-old regularly watered washes was significantly higher than in other washes ($p<0.05$). No difference of *Salmonella* growth in 59-day-old washes was found.**

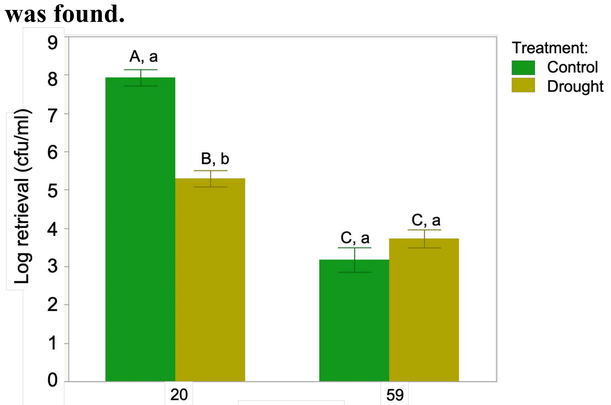


Figure 1. *S.* Newport population after 24 h inoculation in kale washes. Different capital letters indicate statistically significant differences between treatments ($p < 0.05$). Different small letters indicate statistically significant differences within the same treatment ($p < 0.05$).

- **Under negative mode, kale leaf wash profiles acquired from 59-day-old plants significantly differed from 20-day-old kale leaf washes ($p<0.05$). Profiles of 20-day-old kale washes acquired from drought-exposed plants exhibited differences with control ($p<0.05$). More variability was detected among samples of 8-week-old drought treated plants than control (regularly watered) plants.**

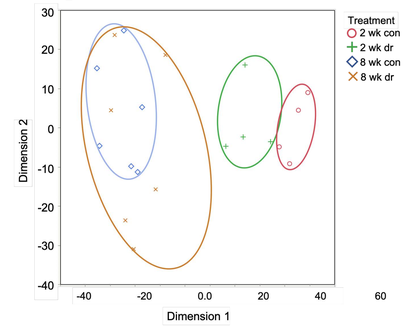


Figure 2. MDS profiles acquired using kale wash samples using ESI-MS under negative mode.

- **Under positive mode, kale wash profiles acquired from 59-day-old control plants diverged from 20-day-old plant washes ($p<0.05$). Profiles of 20-day-old kale washes acquired from drought-exposed kale showed significant differences compared to controls ($p<0.05$).**

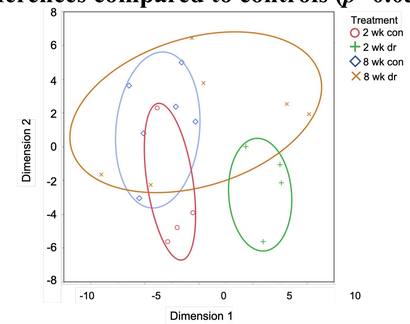


Figure 3 MDS profiles acquired using kale wash samples using ESI-MS under positive mode.

CONCLUSIONS & DISCUSSION

- **Drought significantly restricted the growth of *Salmonella* in juvenile kale washes. As plants aged, drought did not cause further restriction of *Salmonella* in washes after 24 hours.**
- **Drought in juvenile plants and plant age impacted the exometabolome profiles of kale leaves.**
- **Final Goal: to identify compounds in plant washes that inhibit the growth of *S. enterica.***

REFERENCES

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Contact: Shirley Ann Micallef: smicall@umd.edu