AGRICULTURAL UNIVERSITY OF ATHENS
Department of Food Science and Human Nutrition
Laboratory of Microbiology and Biotechnology of Foods

Ability of *Salmonella enterica* and *Staphylococcus aureus* to develop biofilm community on stainless steel and colonize rocket tissue

Agapi I. Doulgeraki[1]*, Efstathios Giaouris[2], and George-John E. Nychas[1]

[1] Laboratory of Microbiology and Biotechnology of Foods, Department of Food Science and Human Nutrition, Agricultural University of Athens, Iera Odos 75, Athens, 11855, Greece
[2]Department of Food Science and Nutrition, University of the Aegean, Mitropoliti Ioakeim 2, Myrina, 81400, Lemnos Island, Greece
***Contact e-mail: adoulgeraki@aua.gr**

BACKGROUND & GOAL

Salmonella enterica* & *Staphylococcus aureus
- Important human pathogens
- Ability to create biofilms
- Increased number of antibiotic-resistant *S. aureus* strains

+

Raw plant tissues
- Their consumption has been associated with the risk of foodborne diseases
- Severe cross contamination issues

→

Study
The ability of pathogenic strains of these two species to survive and / or grow on either abiotic or plant surfaces needs to be further studied

MATERIALS & METHODS

Attachment & biofilm formation assay

Rocket

or

Stainless steel (SS) coupons in BHI broth

→

Staphylococcus aureus strain COL (MRSA)
or
Salmonella Typhimurium (CDC 6516-60)

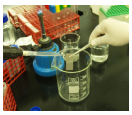
→

20 °C

Recovery of biofilm cells from SS coupons

SS coupons in BHI broth

→



Strong rinsing with ¼ Ringer solution

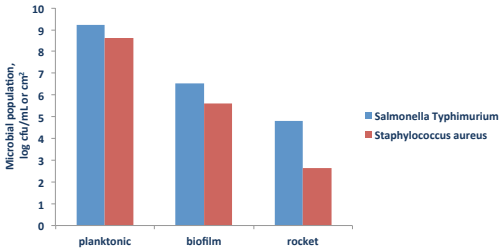
→

Immersion of coupon in ¼ Ringer solution containing glass beads

→

Strong vortexing for 2 min

RESULTS



Final microbial populations (log cfu/mL or cm²) of *Salmonella* Typhimurium (CDC 6516-60) (■) and *Staphylococcus aureus* strain COL (MRSA) (■) on SS coupons immerged in BHI broth (planktonic or biofilm cells) and on rocket tissue following incubation for 6 days at 20°C

- At all cases, higher final populations were observed for *Salmonella* Typhimurium compared to *Staphylococcus aureus*
- The population of *Salmonella* Typhimurium biofilm cells on SS coupons (log CFU/cm²) was about 1 log higher than that of *Staphylococcus aureus* after 6 days incubation
- In the case of rocket tissue colonization, a significant difference (*ca.*= 2 log cfu/cm²) in the ability of these two pathogens to colonize the tissue was observed

CONCLUSIONS & PERSPECTIVES

- Both pathogens were found able to grow attached on either stainless steel or rocket tissue
- Further studies are needed to
  - evaluate the survival and growth of these two pathogens as "real biofilm communities" on plant tissues
  - study their pathogenic potential during such sessile growth

European Union European Social Fund
OPERATIONAL PROGRAMME EDUCATION AND LIFELONG LEARNING Investing in knowledge society
MINISTRY OF EDUCATION & RELIGIOUS AFFAIRS MANAGING AUTHORITY
NSRF 2007-2013
Co-financed by Greece and the European Union

The action THALIS: "Biological Investigation Of the Forces that Influence the Life of pathogens having as Mission to Survive in various Lifestyles; BIOFILMS", has been co-financed by the European Union (European Social Fund – ESF) and Greek national funds through the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF) - Research Funding Program: THALES. Investing in knowledge society through the European Social Fund.

Ability of *Salmonella enterica* and *Staphylococcus aureus* to develop biofilm community on stainless steel and colonize rocket tissue

Agapi I Doulgeraki[1,2], Efstathios Giaouris[2], George-John E. Nychas[1]

[1]Department of Food Science and Human Nutrition, Laboratory of Microbiology and Biotechnology of Foods, Agricultural University of Athens (AUA), Iera Odos 75, Athens, 11855, Greece
[2]Department of Food Science and Nutrition, University of the Aegean, Mitropoliti Ioakeim 2, Myrina, 81400, Lemnos Island, Greece

Salmonella enterica and *Staphylococcus aureus* are important human pathogens capable of causing a diverse array of diseases, while international organization (EFSA, FAO/WHO) report that these are among the most related microorganisms for foodborne diseases. The ability of both species to form biofilm, together with the increased number of antibiotic-resistant *S. aureus* strains, including ones resistant to methicillin (MRSA), are of special interest for researchers. In addition, the consumption of raw plant tissues, have been recently associated with foodborne diseases outbreaks due to cross contamination. Obviously, the ability of pathogenic strains of these species to survive on either abiotic or plant surfaces needs to be further studied.

In the present study, the ability of *S.* Typhimurium (CDC 6516-60) and *S. aureus* strain COL (MRSA) to both develop a biofilm community on stainless steel (SS) and colonize rocket tissue was investigated (incubation at 20°C for 144 h). In parallel, the planktonic growth of these pathogens in Brain Heart Infusion (BHI) broth, was followed.

Following incubation, the population (log CFU/cm^2) of *S.* Typhimurium biofilm cells on SS coupons was about 1 log higher (6.53) compared to *S. aureus* sessile population (5.63). Similarly, in the case of rocket tissue colonization, a significant 2 log difference in the attachment capability of these two pathogens was observed. Obtained results reveal that both pathogens studied here are able to grow on rocket tissue, however, further studies are needed to better determine the survival and / or growth of these as "real" biofilm cells on plant tissues. Additionally, the study of their pathogenic potential during such growth is crucial for food safety.

Acknowledgments

This work was financed by the action THALES: "Biological Investigation Of the Forces that Influence the Life of pathogens having as Mission to Survive in various lifestyles; BIOFILMS", co-financed by the European Union (European Social Fund – ESF) and Greek national funds through the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF) - Research Funding Program: THALES. Investing in knowledge society through the European Social Fund.