

Antimicrobial, anti-quorum sensing and anti-virulence potentials of pomegranate (*Punica granatum* L.) peel extracts against foodborne pathogenic bacteria.

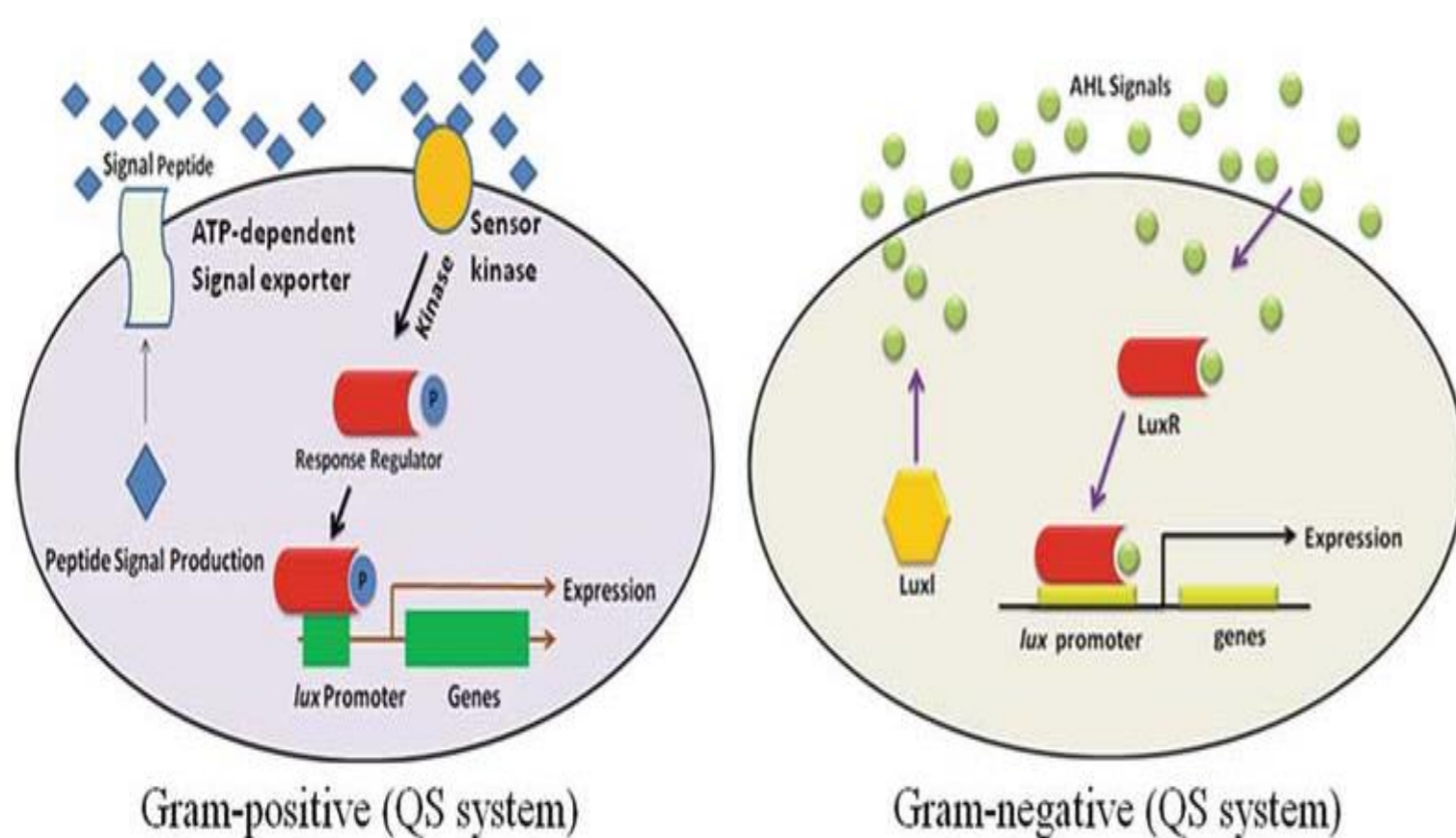
Amira Salim

Dept. of Agriculture, Sec. of Environmental and Food Sciences and Technologies, University of Sassari.

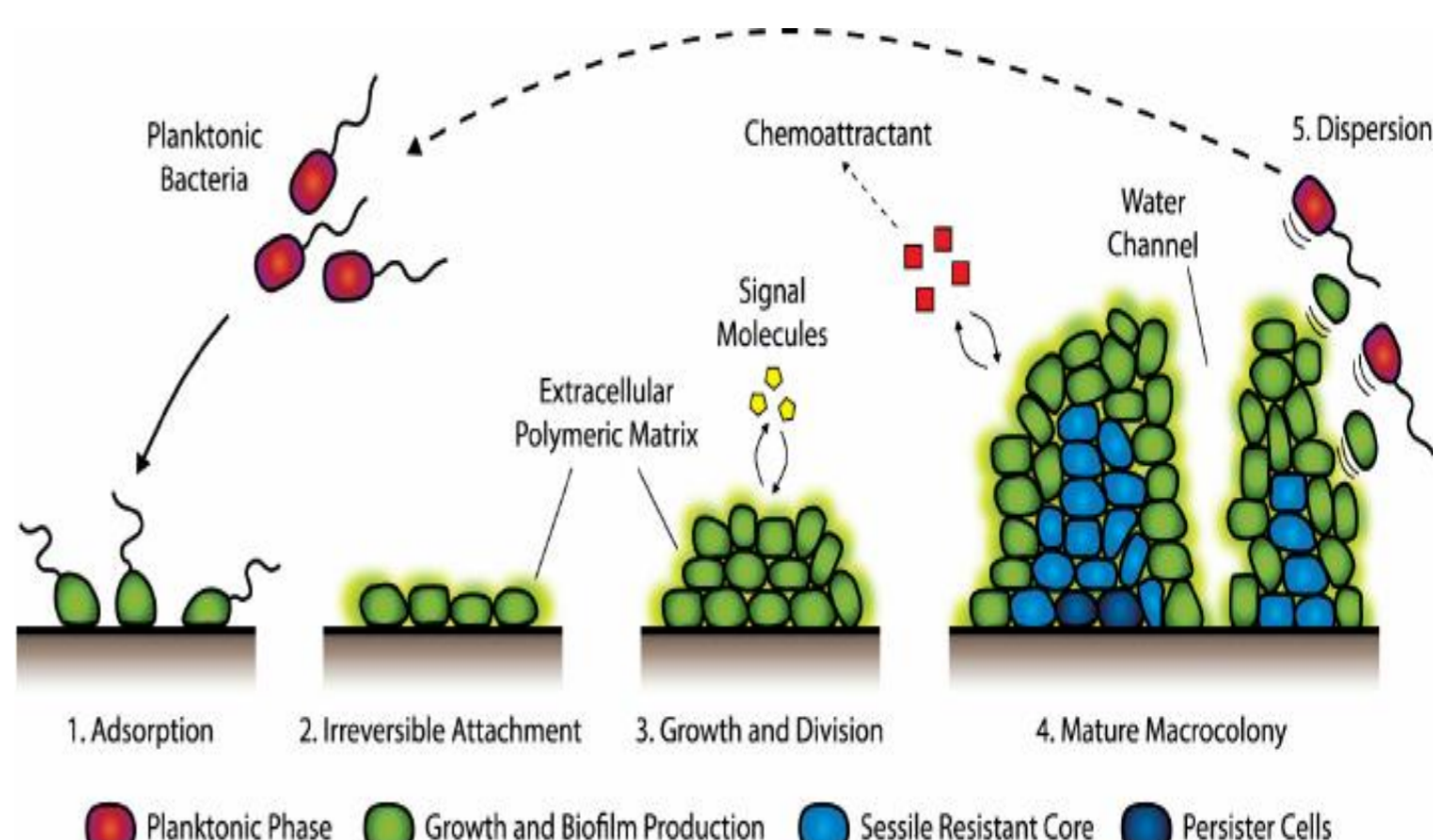
Introduction

Pathogenic bacteria have been a matter of public health concern since the early days of food industry, while foodborne diseases caused by major foodborne pathogens, such as *Staphylococcus*, *Salmonella* and others occur massively worldwide. Pomegranate (*Punica granatum* L.) peel extract PPE is one of the richest in health-promoting natural products that has been vastly used in biocontrol approaches. *Punicalagin*, which is the main polyphenolic active compound in PPE has been reported to possess many properties, such as antimicrobial, antioxidant, and immunosuppressive activities, in addition to regulating what is called “quorum sensing system” (QS) which is a cell-to-cell communication process and a gene regulatory mechanism that plays a vital role in the regulation of microorganisms’ pathogenicity. Bacteria use this QS system to control a variety of physiological processes such as biofilm formation, conjugation, and virulence, antibiotic production, swarming, motility and sporulation. This phenomenon of QS draws attention to the process of mitigation of microbial infection, where the plant-derived compounds block several essential pathways like biofilm formation and virulence factor expression and which are controlled by QS system.

Quorum sensing



Biofilm formation



Objects:

Generally, this PhD thesis research project is aiming to investigate the antimicrobial capacity of the PPE on several foodborne pathogenic bacteria, together with the chromatography chemical analysis of the PPEs. Finally, gene expression analysis will be done where an evaluation of the PPE abilities to down-regulate the expression of several genes which are involved in quorum sensing, biofilm formation and virulence will be conducted.

- A1. Aqueous extraction of PPEs from seven different pomegranate varieties.
- A2. Determination of antimicrobial activity and PPE bioactive compounds antioxidant efficiency.
- A3. Phytochemical composition analysis of the PPE bioactive compounds using High-performance liquid chromatography HPLC.
- A4. Bacterial RNA extraction and gene expression analysis.
- A5. Writing of the PhD thesis and scientific papers.

Expected results:

- ✓ The PPE of the pomegranate different varieties show antimicrobial and antioxidant efficiency.
- ✓ Measuring significant concentrations of total phenolics, tannins, flavonoids, and anthocyanins.
- ✓ PPEs shows abilities to down-regulate the expression of several genes which are involved in quorum sensing, biofilm formation and virulence.

References:

- Čirić AD, Petrović JD, Glamočlija JM, Smiljković MS, Nikolić MM, Stojković DS, Soković MD (2019) Natural products as biofilm formation antagonists and regulators of quorum sensing functions: A comprehensive review update and future trends, *South African Journal of Botany* 120: 65-80.
- Erdönmez D, Rad AY, Aksöz N (2018) Anti-quorum sensing potential of antioxidant quercetin and resveratrol, *Brazilian Archives of Biology and Technology* 61.
- Li G, Yan C, Xu Y, Feng Y, Wu Q, Lv X, Yang B, Wang X, Xia X (2014) Punicalagin inhibits *Salmonella* virulence factors and has anti-quorum-sensing potential, *Applied and environmental microbiology* 80: pp.6204- 6211.
- Peter AE, Sudhakar P, Sandeep BV, Rao BG (2019) Antimicrobial and anti-quorum sensing activities of medicinal plants. “In Implication of Quorum Sensing and Biofilm Formation in Medicin”, *Agriculture and Food Industry* pp 189-217.
- Oh SK, Chang HJ, Chun HS, Kim HJ, Lee N (2015) Pomegranate (*Punica granatum* L.) Peel extract inhibits quorum sensing and biofilm formation potential in *Yersinia enterocolitica*, *Microbiology and Biotechnology Letters* 43: 357-366.