Rhizosphere Immunity: Plants Differentiate Beneficial and Pathogenic Bacterial Growth

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Abstract

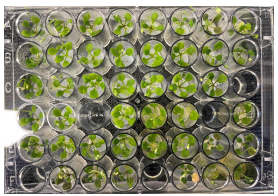
Plant roots in soil are constantly surrounded by endless amounts of beneficial and pathogenic bacteria. Symbiotic bacterial interactions promoted by plants are necessary to achieve optimal development and growth. Pathogenic bacterial growth suppression is essential to maintain a healthy and optimal growth pattern for a plant. By analyzing the growth of bacterial fluorescence, I compared the growth of pathogenic and beneficial bacteria in Col0 plants. Through in planta experiments and data analysis, I determine that beneficial bacterial growth outcompetes pathogenic growth. I can conclude that plant hosts are able to distinguish between pathogenic and beneficial bacteria growing in the rhizosphere. Due to the plants ability to promote growth for beneficial bacteria, while preventing growth from pathogenic bacteria, there may be a difference in immune-elicited responses.

Introduction

- My future research will further explore the mechanisms surrounding rhizosphere interactions between beneficial and pathogenic bacteria
- The data collected and analzyed from this project will aim to inform future research in the field of discovering plant immunity reactions in the rhizosphere

Methods

- To discover how plant hosts are able to differentiate between beneficial and pathogenic, I used two genetically similar strands of Pseudomonas fluorescens, one beneficial and one pathogenic.
- Within these two different bacteria strains, there is a crimson or neon green fluorescent protein resulting in four individual strains.
- The plants were allowed to grow for twelve days, and were then inoculated with either the pathogenic or beneficial bacteria.
- After the tweleve days, the floruscence of the plants were measured daily for each strain and color type



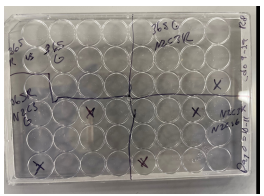
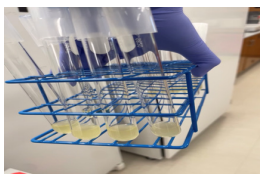
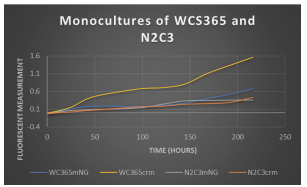


Figure 1a (Left) illustrates the plants after two weeks of the bacterial innoculation Figure 1b (Top Right) illustrates the labeling and sectioning of plants based off strain and flourescent color Figure 1c (Bottom Right) illustrates the four different bacterial solutions used to innoculate the plants



Results



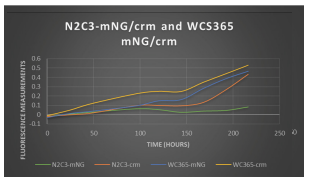
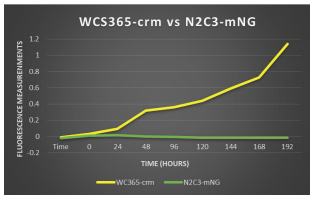


Figure 2a (Top): Relationship between bacterial growth due to different strains and different color flourescent proteins
Figure 2b (Bottom): Relationship between bacterial growth due to competition between the same strain with different color flourescent proteins



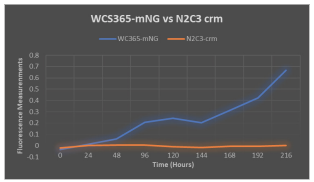


Figure 3a (Top): Relationship between bacterial growth due to competition between WC365-crm and N2C3-mNG
Figure 3b (Bottom): Relationship between bacterial growth due to competition between WC365-mNG and N2C3 crm.

Conclusion

- WCS365-crm significantly outgrows all the other strains when comparing monoculture growth (Fig. 2a)
- When comparing WCS365 crm vs mNG, WCS365 crm outperforms WCS365 mNG (Fig. 2b) and N2C3 crm outgrows N2C3 mNG (Fig. 2b)
- When WCS365-crm and N2C3-mNG are grown together, N2C3-mNG does not grow at all (Fig. 3a)
- When WCS365-mNG and N2C3-crm are grown together, N2C3-crm does not grow at all (Fig. 3b)