Variable Antibiotic Production among Soil Bacteria Populations in the presence of Differing Plant Habitation

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Abstract

A study was conducted in order to determine the effects of plant habitation on soil bacteria and their antibiotic production within the soil. Cores were serially diluted in water to obtain a final dilution of 10^-3, 10^-4, 10^-5. Three 5" soil cores were obtained from each site. A preliminary survey of the Greene property was taken and 4 sites were selected. Site 1 is a marshy wetland area near pond, Site 2 is a grassy path near pond, Site 3 is a more densely wooded area near pond, and Site 4 is small forested area. Cores were serially diluted in water to obtain a final dilution of 10^-3, 10^-4, 10^-5. Soil Dilutions 10^-3, 10^-4, and 10^-5 were pour plated on plates and incubated for 1 week at 25°C. Several samples were selected from each site. One of these colonies grew much quicker than the rest and spread across much of the plate growing near many other selected colonies. Indeed what was observed looked very much like a ZOI. It appeared that several of the colonies growing near each other were secreting an antibiotic that prevented the rapidly growing colony from growing any closer to them. Several tests conducted suggesting perhaps this was not a bacterium but a fungus instead. Additionally, after the soil dilutions were pour plated it was observed in several instances that where two colonies grew close to each other one formed a ZOI while the other did not. Several of these colonies were tested against E.coli or S.aureus however, no ZOIs were formed. When these organisms were tested against the selected colonies growing near each other, one formed a ZOI while the other did not. Statistics for the data gathered were not significant. As already established in the results section, it happened that the selected soil dilution might not be producing indicatives that can prevent fungal growth. While this project was concerned with interactions between bacteria, this observation certainly is intriguing. It is reasonable to expect that bacteria may have several different mechanisms to use against other competing bacteria in order to survive. Several different mechanisms may be employed to combat the project on a much larger scale. Taking such measures would also aid in determining frequency of antibiotic production per gram of soil. If one desired to take this work even further, other antibiotic producing bacteria, such as Bacillus subtilis or other soil bacteria might be a better indicator of antibiotic production. Antibiotic production is a complex issue and as this research is ongoing, much is still unknown about the interactions of soil bacteria and their production of antibiotic molecules and the role of antibiotic production in the soil bacteria population. Frequency of antibiotic production at each site will be recorded to identify trends between soil type and amount of antibiotic production. It is hoped that this will shed more light on the selection pressure that these microorganisms encounter.

Introduction

In a study conducted by Bennett et al., it was determined that soil samples represented a habitat for soil bacteria and their antibiotic production within the soil were examined (1). At this time, little is known about antibiotic production within soil bacteria, so the authors wanted to find out how antibiotic producing bacteria were grouped within a soil sample spectrum in hopes to learn more about the antibiotic spectrum that bacteria obtain. It was found that equipment used to test these samples were high in variation and labeling was low. By using a preliminary survey of the Greene property, 4 sites were selected to test the effect of soil bacteria on plant habitation. Perhaps if this study was conducted with a greater variation of soil samples, a trend within bacterial distribution would be observed and might provide some insight as to what selective pressures microbial communities face in a soil ecosystem. The focus of this study will be to see if there is a correlation between the amount of antibiotic production within soil and the type of vegetation growing on the soil.

Methods

A preliminary survey of the Greene property was taken and 4 sites with different plant vegetation were selected.

- Core 1 was a grassy path near pond with many trees.
- Core 2 was a more densely wooded area near pond with many trees.
- Core 3 was a marshy wetland area near pond with many trees.
- Core 4 was a small forested area near pond with many trees.

Cores were serially diluted in water to obtain a final dilution of 10^-3, 10^-4, 10^-5. Soil Dilutions 10^-3, 10^-4, and 10^-5 were pour plated on plates and incubated for 1 week at 25°C. Several samples were selected from each site. One of these colonies grew much quicker than the rest and spread across much of the plate growing near many other selected colonies. Indeed what was observed looked very much like a ZOI. It appeared that several of the colonies growing near each other were secreting an antibiotic that prevented the rapidly growing colony from growing any closer to them. Several tests conducted suggesting perhaps this was not a bacterium but a fungus instead. Additionally, after the soil dilutions were pour plated it was observed in several instances that where two colonies grew close to each other one formed a ZOI while the other did not. Several of these colonies were tested against E.coli or S.aureus however, no ZOIs were formed. When these organisms were tested against the selected colonies growing near each other, one formed a ZOI while the other did not. Statistics for the data gathered were not significant. As already established in the results section, it happened that the selected soil dilution might not be producing indicatives that can prevent fungal growth. While this project was concerned with interactions between bacteria, this observation certainly is intriguing. It is reasonable to expect that bacteria may have several different mechanisms to use against other competing bacteria in order to survive. Several different mechanisms may be employed to combat the project on a much larger scale. Taking such measures would also aid in determining frequency of antibiotic production per gram of soil. If one desired to take this work even further, other antibiotic producing bacteria, such as Bacillus subtilis or other soil bacteria might be a better indicator of antibiotic production. Antibiotic production is a complex issue and as this research is ongoing, much is still unknown about the interactions of soil bacteria and their production of antibiotic molecules and the role of antibiotic production in the soil bacteria population. Frequency of antibiotic production at each site will be recorded to identify trends between soil type and amount of antibiotic production. It is hoped that this will shed more light on the selection pressure that these microorganisms encounter.

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References


Discussion

As already established in the results section, it happened that the selected soil dilution might not be producing indicatives that can prevent fungal growth. While this project was concerned with interactions between bacteria, this observation certainly is intriguing. It is reasonable to expect that bacteria may have several different mechanisms to use against other competing bacteria in order to survive. Several different mechanisms may be employed to combat the project on a much larger scale. Taking such measures would also aid in determining the frequency of antibiotic production per gram of soil. If one desired to take this work even further, other antibiotic producing bacteria, such as Bacillus subtilis or other soil bacteria might be a better indicator of antibiotic production. Antibiotic production is a complex issue and as this research is ongoing, much is still unknown about the interactions of soil bacteria and their production of antibiotic molecules and the role of antibiotic production in the soil bacteria population. Frequency of antibiotic production at each site will be recorded to identify trends between soil type and amount of antibiotic production. It is hoped that this will shed more light on the selection pressure that these microorganisms encounter.