The Effect of Mites on the Number of Soil Bacteria

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Abstract

Protozoa, bacteria, and mites are three soil organisms that have a complex relationship. Both mites and protozoa eat bacteria and consequently have an inverse relationship with each other. Our group hypothesized that as the amount of mite's increase in an area then the amount of bacteria will decrease in the same area. We tested our hypothesis by examining soil samples for the density of bacteria and number of mites. Our hypothesis was proven to be incorrect.

Introduction

Three groups of soil organisms that have a complex relationship with each other are mites, protozoa and bacteria. For example, mites play a huge role in any woodland environment. They are fond of damp places, and along with "ticks are the most ubiquitous single animal group, living in nearly every terrestrial aquatic habitat, including deep soils and forest canopies, cold and thermal spring and subterranean waters" (Lindquist and Behan –Pelletier, 2008. Mites are scavengers who "have developed non-predacious feeding habits (feeding on bacteria, yeasts, fungi, algae, mosses and higher plants)" (Evert E. Lindquist and M. Behan-Pelletier, 2008).In particular, mites are scavengers of bacteria, and in many soil ecosystems, mites feed off bacteria as their main source of food.

Bacteria have a huge impact on soil environments for a number of reasons. Without bacteria performing their job of recycling chemical elements and chemical compounds in nature, life on Earth would not occur. Bacteria are also the only organism to carry out the nitrogen fixation, converting nitrogen into ammonia that plants use to grow. Bacteria also play a huge role as a major component of the decomposition process in the environment. "By decomposing organic material for energy, these microorganisms help recycle nutrients like nitrogen and carbon back into the environment. If it were not for these decomposers, the organic carbon in dead and rotting organisms would remain locked underground, effectively stopping the carbon cycle." (Library. Think Quest, 2005) Without bacteria performing their various jobs, any environment would rapidly collapse.

Another organism that is equally vital to natural environments are protozoa. These organisms play a major role in the environment by eating various plants and creatures. They primarily feed on bacteria during nutrient cycling, and help the environment by regulating the bacteria populations. By feeding on bacteria, these protozoans stimulate bacterial growth and release nitrogen, which goes straight back into the environment in the form of ammonium for use by plants. Furthermore, protozoa are a primary food source of soil organism and "suppress disease by competing with or feeding on pathogens" (Ingham, 2008).

After the E.S.S.R.E. 2008 Biota Survey (2008), we discovered a discrepancy in the Roland Park Country School backwoods. We found that there were unusual levels of bacteria and protozoa in the environment. Because this relationship is normally an indirect one, we found it odd that the amount of protozoa did not increase when the amount of bacteria decreased. We noticed, however, that there were unusually high levels of mites in this location. Therefore, we hypothesized that as the amount of mite's increases in an area then the amount of bacteria will decrease in that same area because of the mites scavenging on the bacteria and consequently so will the protozoa that normally feed on the bacteria.

Methods

At E.S.S.R.E. SITE 1 (N 39.35794 W 076.63977) and SITE 4 (N 39.35733 W 076.63840), 3 samples of soil, 15 centimeters deep by 2.5cm in diameter, were taken to measure bacteria density. Serial Dilutions were performed to 10^{-4} level on each sample and 100µl of each dilution was plated on 3M Petrifilm Bacteria Growth Plates. At the same time, each location was tested for the number of mites. 0.5x 0.5 m^2 plots were examined to a depth of 15cm and the number of mites found was recorded. This process was continued for 4 additional days; each day a different quadrat was examined.

Sample Results

Data Table1: Average Number of Mites per ½ meter square

Days	Site 1	Site 4
1	0	25
2	0	0
3	1	0
4	25	0
5	0	0

Data Table 2: Average Bacteria per cubic cc- Site 1

Days	Average Bacteria (per cubic cc)
1	203333.3
2	116666.7
3	700000
4	33300000
5	6900000

Data Table 3: Average Bacteria per cubic cc- Site 4

Days	Average Bacteria (per cubic cc)
1	6533333.33

2	**1800000**
3	**5833333.33**
4	**663333.33**
5	**22300000**

Discussion

After counting the bacteria plates, we saw that when the density of bacteria increased or decreased the number of mites did the same, respectively. For example as graphs 1 and 2 show, in Site 1 on days 1 and 2, both the number of mites and amount of bacteria slightly decreased. While on days 2 and 3, the number of mites increased; but they only went up by one per ½ meter square. Also in Site 1 on days 3 and 4, both the number of mites and the density of bacteria increased significantly from 700,000 to 33,300,000 bacteria per cubic cc and from 1 to 25 mites per ½ meter square. However, in site 4 on days 1 and 2 the number of bacteria decreased dramatically from 6,533,333.33 to 1,800,000 per cubic cc as the number of mites also dropped from 26 to 0 per ½ m square.

Furthermore, on days 2, 3, and 4 the numbers of bacteria and mites did not reflect the scientific relationship that we had expected, that is, as mites increased, the number of bacteria did not decrease. Rather, in Site 1 from day 3 to 4, while the number of mites increased, the relatively high P-Value of .419 confirmed that there was not a significant decrease in the levels of bacteria. Similarly, in Site 4 from days 2 through 4, the number of mites increased, P-Values of .464, .864, and .312 show that there were no statistically significant differences in the levels of bacteria. Therefore, we found that our hypothesis was incorrect and that mites had nothing to do with the anomalous protozoa and bacteria numbers observed in Site 1 during the original biota survey.

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