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The Effects of *Spathiphyllum Cochlearispathum* Plants on Indoor Airborne Spores

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ABSTRACT

Recent studies suggest that low-light requiring house plants aid in the improvement of air quality indoors in energy efficient buildings. This study addresses the influence of *Spathiphyllum* plants on indoor airborne spores in an indoor environment that is in an energy efficient building. During the months of January and February of the year 2015, airborne indoor bacteria and fungi were assessed using conventional methods to investigate the enumeration of airborne micro-organisms. In order to gather information pertaining to the air quality, 'open plate technique' was used. It is a method in which petri dishes containing agar were exposed to the air in the different treatments in order to collect any airborne spores. These samples were collected during the month of January and February in a controlled indoor environment. All trails occurred in the same location. The location was a basic room in the building of a science building. After collecting data and analyzing, it appears that the only real difference occurred between the control group and the treatment with just the plant and soil.

Keywords: *Indoor Airborne Spores, Spathiphyllum, Cochlearispathum, House-Plant,*

INTRODUCTION

It is estimated that about 50% of the world's population lives in urban areas and spend approximately 90% of their life indoors. (Wood RA 2008) The issue with that is that indoor air quality in energy efficient buildings is 2-5x worse than the air we breathe outdoors. (Wood RA 2006) This leads to a number of negative side effects to the health of a human being. Such negative effects include but are not limited to allergies, asthma, and cancer. (Wood RA 2008) This in result can lead to a decrease in the quality of ones life. Indoor quality is regarded as an international concern. (Wood RA 2008) Some potential things that one could be breathing in are particulate matter and gaseous pollutants. (Bergs)

A potential solution to this issue is using low-light requiring house plants. For this research, *Spathiphyllum* plants were used. A *Spathiphyllum* Plant is a tropical plant that with its unique properties makes it an ideal plant to grow indoors. Spathiphyllum Plants are a tropical plant located deep down underneath a canopy of a tropical forest. Due to its location, the plant has adapted to requiring low light and small amount of water. This makes this plant an ideal plant to grow indoors.

Although it is believed that house plants can cause an increase in the number of airborne spores, a number of studies actually suggest that Spathiphyllum Plants can aid in the reduction of airborne spores (Burchett). A study done by J. D. Wolverton and B. C. Wolverton shows that the number of airborne spores can be reduced by over fifty-percent.(Wolverton BC) Research studies have shown that houseplants absorb, metabolize, or translocate air polluting organic chemical to microbes growing on and around plant roots where they are biodegraded (Wolverton BC).

The science behind the house plants improving air quality is that it has been discovered that plant leaves emit low levels of substances that suppress the growth of airborne microbes in their immediate vicinity (Wolverton BC). The substances that are released from the plant may include allelochemicales which has been known to be released in order to reduce competition by other plants or in order to protect itself from harmful microbes, insects, or animals. This explains how low-light requiring plants, such as a *Spathiphyllum* plant, that evolved in a humid environment underneath the canopy of tropical rain forests, protect themselves from being overwhelmed by molds and other microbes that normally flourish in damp, warm, low-light environment (Wolverton BC).

There are a number of direct health benefits from these indoor plants. A study found that staff sick leave was reduced by over 60% when indoor plants were installed. (Burchett) Not only was the amount of staff sick leaves were reduced but also the study found that there were less sick leave absences among school children. Another significant finding from the presence of house plants was that there was 37% less coughing, 30% less fatigue, and a 23% reduction in symptoms such as headaches, sore eyes, nose, or throats, "heavy-headness, or lowered concentration. (Burchett) *Spathiphyllum* plants have the ability to be strong air purifiers. (Fjeld)

For this study, the effects of Spathiphyllum Plants on indoor airborne spores in a controlled environment were done. The purpose of this study was to determine if there was in fact a reduction of airborne spores from these house plants.

MATERIALS AND METHODS

There were 3 different variables used in order to gather data pertaining to the effects of *Spathiphyllum* plants on indoor airborne spores. The 3 variables were

the *Spathiphyllum* plant, a pot with soil, and neither the soil nor the *Spathiphyllum* plant which was the control variable. The 3 variables essentially had the exact same conditions except the variables were different. This means the location, temperature of the room, and time of the experiment were all the same. The 3 variables were put in separate 58qt plastic boxes. Each box contained petri dishes that contained plate count agar. This was used to collect and culture airborne microbes. For 24 hours, the lids of the boxes were closed with the 3 variables. After the 24 period was completed, the lids of the petri dishes were removed and remained that way for a 2 hour period. Upon completion of each 2 hour exposure, lids were replaced on the petri dishes. The dishes were then placed in an incubator at 28 degrees Celsius for 48 hours. After the 48 hours, petri dishes were removed from the incubator and the number of "colony forming units" was recorded. This was repeated for a total of 96 times.

RESULTS

Table 1 represents the relationship between the amounts of airborne spores collected vs the trail number. There was 8 different trials that occurred. Each of the 8 trials had 3 different treatments. The 3 different treatments were the control group which was the containers that had no soil or plant present, a container that contained just the pot of soil, and a container that had the plant and soil present. There were 4 containers for each of the different treatments in each trial. An ANOVA test was ran to see if there was a difference in amount of airborne spores collected in each of the trails. The p value was greater than .05 which meant there was no difference.

Table 2 represents the relationship between the amount of airborne spores and the different treatments. An ANOVA test was ran in order to see if there was a real difference. The P value was less than 0.05 which means there was a real difference.

Table 3 represents the further investigation that was done to locate exactly where the differences was. A Post Hoc Test was used to find this information. There were multiple comparisons done. The first comparison was which was the control group vs the treatment with just the pot and soil. The p value was less than 0.05 which meant there was a real difference. This was the only comparison that showed a real difference. When comparing the control group to the treatment with the plant and soil, there was no significant difference. The p value was greater than 0.05. As well there was no significant difference in the treatment with the pot and soil vs the treatment with the plant and soil. The p value was greater than 0.05.

Figure 1 represents the means and standard error of the different treatments and the amount of airborne spores that were collected. The control group had a mean of 2.53, the treatment with just the soil and the pot had a mean of 4.50, and the treatment with the plant and soil had a mean of 2.97. The standard error for the control group was 0.284, for the treatment with just the soil and pot it was 0.426, and the treatment with the plant and soil was 0.803.

Table 1. This represents the relationship between the amount of airborne spores collected vs the different trials. P > .05 which means there was no real difference. An ANOVA test was used for this data.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.500	1	3.500	.341	.560[b]
	Residual	963.833	94	10.254		
	Total	967.333	95			

Table 2. This represents the relationship between the amount of airborne spores vs the different treatments. P < .05 which means there was a real difference. An ANVOA test was used for this data**.**

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	68.396	2	34.198	3.538	.033
Within Groups	898.938	93	9.666		
Total	967.333	95			

Table 3: This represents the further investigation to see the difference between the relationship between the amount of airborne spores collected vs the different treatments. No Plant or Soil Present vs Only Soil Present P < .05. No Plant or Soil vs Plant with Soil P > .05. Plant with Soil vs Only Soil P > .05. A Post Hoc test was used for this data.

(I) Treatment	(J) Treatment	Mean Difference (I-J)	Std. Error	Sig.
No Plant or Soil Present	Only Soil	1.96875*	.77725	.034
	Plant with Soil	.43750	.77725	.840
Only Soil	No Plant or Soil Present	1.96875*	.77725	.034
	Plant with Soil	1.53125	.77725	.125
Plant with Soil	No Plant or Soil Present	.43750	.77725	.840
	Only Soil	1.53125	.77725	.125

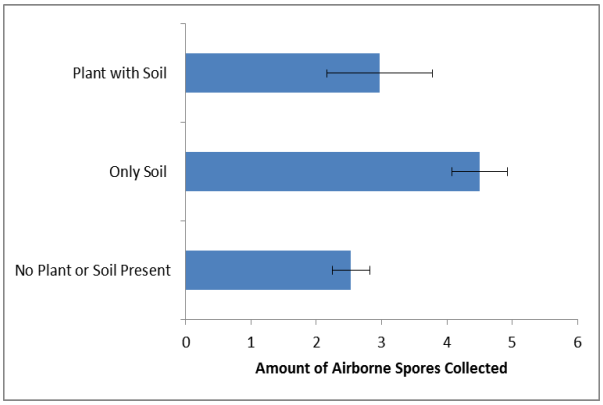

Figure 1. This represents the Means and Standard Error for the different treatments and the amount of airborne spores collected**.**

DISCUSSION

Table 1 represents the relationship between the different trails and the amount of airborne spores that were collected. It was predicted that there would not be a significant difference. This was predicted because the trials were essentially set up and ran exactly the same in each trials. An ANOVA test was ran to see if there was no difference. As expected, there no was real difference.

Table 2 represents the relationship between the amount of airborne spores and the different treatments. It was predicted that the amount of airborne spores collected for the treatment with the plant and soil would have the least amount of airborne spores collected. It was also predicted that the control group would be the treatment that collected the most airborne spores. The treatment with the just the pot and soil was used in order to see if the soil played a role in the improvement of air and therefore was predicted to have somewhere in the middle of the other two treatments. An ANOVA test was first ran to see if there was any difference between the different treatments. The p value was less than 0.5 which meant there was a real difference.

Table 3 represents the further investigation. A Post Hoc Test was ran to locate the difference. What was discovered was that there was only one comparison of the different treatments that showed a real difference. When comparing the control group to the treatment with just the pot and soil, there was a real difference.

Figure 1 represented the means and standard errors of the different treatments and the amount of airborne spores collected. After the studies were done and the data was collected, there was a bit of a surprise. In one of the trials, there was a significant amount of airborne spores collected in the treatment with the plant and soil. There were 3 outliers in the trials with the treatment of the plant and soil. The cause is uncertain. There must be more trials done in order to see if this trend continued and perhaps get a better understanding as to why there were a couple trials with outliers.

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