The Effect of Weather Conditions on Insect Activity

Steven Li, Yilin Wei

liisteve@yahoo.com, yilinwei2017@126.com

Abstract

People often claim that they observe an increased amount of insect activity after rain. Some articles suggest that water accumulation in the soil forces insects to leave the ground which increases insect activity. Others state that a number of insects prefer a humid environment and therefore are more active after rain. However, there is no scientific evidence to support the observation. In this experiment, we tried to validate the above statement by examining whether there was a significant difference between the number of insects observed on sunny days compared to that observed on cloudy days after rain. We collected one set of data from a grass field and another from a soil land under a maple tree. For each location, we recorded the number of insects observed in two types of weather six times in pairs. The analyzed data from both locations suggested an insignificant difference between the number of insects observed in the two weathers. The observed increase in insect activity after rain could be a misjudgement due to a higher frequency of insect appearance. Overall, we did not have enough evidence to conclude that there is higher insect activity observed after rain

Introduction

Many people complain that they observe higher insect activity after rain compared to sunny weather. According to a pest prevention report, the likelihood of pest infestation increases after rain ("How to Deal with Insects After a Storm."). There are several well-known explanations behind this phenomenon. One of which suggests that the water soaked into the ground forces insects to seek shelter on a higher altitude ("How Weather 1

Affects Insects."). This often induces large-scale insect invasion which leads to higher observed activity. Another popular explanation states that sometimes the soil environment becomes unsuitable for insects to reside in rainy weather. Due to water accumulation in the soil pores, the diffusion rate of oxygen slows down dramatically. Insects such as earthworms suffer from a lack of oxygen and come to the surface to breathe (Porter). This also contributes to higher observed insect activity. The last explanation relates the observation to insect preferences. Many insects such as snails are more active after rain because they favor a humid atmosphere. After a storm, the mosquitos are also more aggressive and generate more offsprings (Benedict).

There have been a lot of studies discussing how temperature affects insect activity (Kenneth 473-487; Williams and M. 187-189). However, few experiments compared the insect activity observed in specific weather conditions. The objective of our research is to examine whether there is higher insect activity after rain compared to sunny weather. By doing this experiment, we will be able to validate whether or not the observation above is supported by scientific evidence. We will also learn more about insect behavior that could be used in future studies. In this experiment, the insect activity is quantified by the number of insects that are observed in different weathers. Our hypothesis states that if there is higher insect activity after rain, the number of insects we find after rain should be higher than the number of insects we find on sunny days.

During this experiment, we collected six pairwise data from each of the two diverse locations near the UBC campus in order to be comprehensive. In each pairwise data, the first group represented the number of insects collected in sunny weather, the second group represented the number of insects collected in cloudy weather after rain. Data gathered in the two locations were analyzed separately. Our research hypothesis can only be supported when there were significantly higher numbers of insects observed after rain compared to sunny weather

Methods

We prepared the supplies including pens, notebook, cell phones, a small shovel, and raincoats before the experiment. We first chose two diverse locations in the same area to observe the insects. The two locations we chose on the UBC campus were a grass field in front of the Ponderosa buildings and a patch of soil land under a maple tree. We recorded the environment of the locations on the notebook. Next, we conducted pairwise insect observations on different weather conditions. If it started to rain on a specific day, we picked a time after the rain to look for insects in the two locations for 30 minutes. We recorded the start time of the observation, the weather condition including the temperature, and the number of living insects found in each location. For accuracy, we also took photos of the insects for data organization later. When insects fled away and hid under the soil, we used a shovel to dig as little as possible. For insects that appeared in groups, we counted them as one individual to avoid data disproportion. After this observation, we then found a sunny day that had a similar temperature range. We picked the same start time to look for insects in the two locations for 30 minutes. We recorded the data following the above procedures. This concluded one trial of our pairwise observation. We repeated the steps six times to record six pairwise data in each location.

We used an unpaired t-test to analyze the observed data in each location separately. In our experiment, we first performed a t-test on the six pairwise data collected on the grass field. The t-test revealed whether there were any significant differences between the mean number of insects observed in different weathers. Then we performed another t-test on the six pairwise data collected on the soil land under a maple tree. The p-values obtained from the t-tests and the differences between the mean number of insects observed in the two weather conditions decided whether the hypothesis was supported or rejected.

Figure 1. The maple tree location

Figure 2. Argus tortoise beetle found in sunny weather

Figure 3. The grass field location

Figure 4. Snail found in cloudy weather after rain

Result

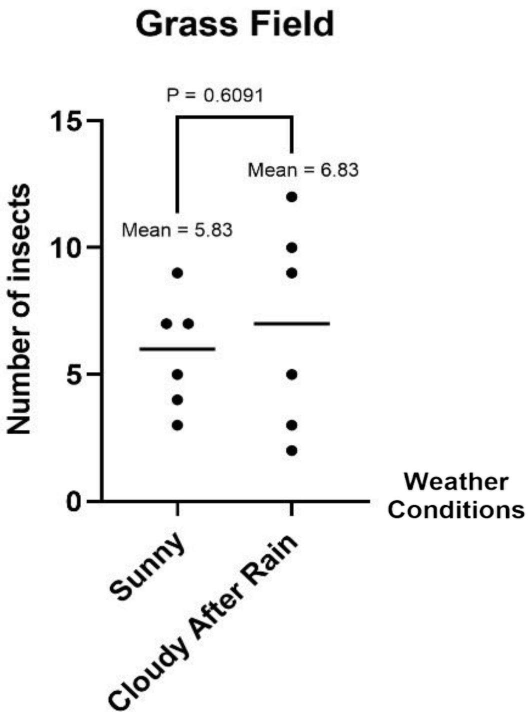

Figure 5. "Grass Field" refers to the grass field near the Ponderosa buildings. Scatter plots with individual values from 6 pair-wise trials on grass field. Mean values and P values are indicated

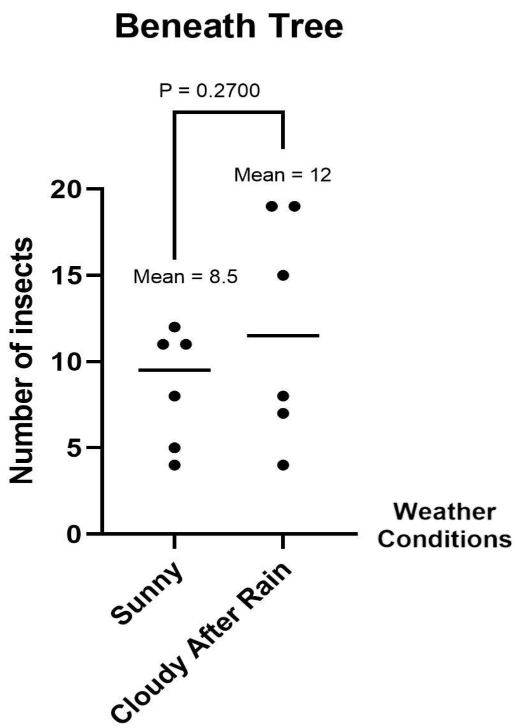

Figure 6. "Beneath Tree" refers to patch of soil beneath a specific tree. Scatter plots with individual values from 6 pair-wise trials on soil beneath a maple tree. Mean values and P values are indicated

An unpaired t-test using α = 0.05 was run on datasets collected in both locations. On the ponderosa grass field, the average number of insects observed in sunny weather was slightly smaller than that observed in cloudy weather after rain. The t-test analysis for the dataset collected in the grass field resulted in a p-value of 0.6091. On soil land beneath a maple tree, the average number of insects observed in sunny weather was smaller than that observed in cloudy weather after rain. The t-test analysis for the dataset collected on the soil land beneath a maple tree resulted in a p-value of 0.2700. The differences between the mean values obtained from the beneath-tree location were slightly larger than the differences between the mean values calculated for the grass field location.

Discussion

Our null hypothesis stated that the mean number of insects observed in sunny weather and cloudy weather after rain were not significantly different. Our alternative hypothesis suggested that the mean number of insects observed in two weather conditions were significantly different. The p-value calculated from analyzing the grass field dataset (0.6091) was higher than the critical value of 0.05. Furthermore, the p-value acquired from analyzing the under-tree soil land dataset (0.2700) was also higher than the critical value. Based on our statistical analysis, both of the results obtained from separate locations failed to reject the null hypothesis. The results showed that there was no significant difference between the average number of insects observed in sunny weather and cloudy weather after rain in both locations. Any observed differences in the number of insects obtained from the two weathers were more likely due to chance. Overall, the result failed to support the alternative hypothesis.

There were several possible explanations for why our hypothesis was not supported by scientific evidence. First of all, the observed higher insect activity after rain may be a result of human bias. On sunny days, insects appear more often in their natural habitat, the soil land. Most people do not notice these creatures. However, insects such as earthworms crawl to places that are more obvious to humans such as the driveway after rain (Lipford). Also as stated in the background, insects that look for shelter are likely to migrate to houses and apartments (“How Weather Affects Insects.”). Thus, insects can have the same level of activeness in two weather conditions. People are just more likely to notice the insects on rainy days.

Sources of errors and variations could also affect our results. An identified error in our experiment was not being able to accurately measure the number of insects due to insects’ size and movement. Some small insects escaped fairly quickly. We were often not certain whether the moving item was an insect or not. Thus, we might have overcounted or undercounted the numbers.

One source of variation was how long after the rain we chose to collect data in each trial. As the day progresses, the insects tend to burrow back into the ground. The results would be most accurate if we conducted each trial just after the rain. Another variation could be the different start times we chose to begin each trial. Due to weather limitations, some of the trials were conducted in the mornings, some were in the afternoons. Different types of insects tend to be more active during different times of the day. For example, most mosquitos are more active during the evening (Butler), however, the butterflies are more active during noon (Vangoidtsenhoven). The results could be more accurate if we had chosen to conduct all trials in the mornings or the afternoons. Also, the number of insects observed in the last few trials were affected by the temperature. Even though we conducted the pairwise observations under similar temperatures, the overall temperature was decreasing in Vancouver. It is likely that only a few insects survived under the cold weather condition (Kenneth). Thus, the number of living insects observed in both types of weather decreased in the last few trials.

Our experiment can only account for the Vancouver west area. Further studies can be done in other locations to obtain more conclusive results. More studies such as how insects adapt to local climate can also be done to further understand the insect behavior.

Conclusion

The results from both t-tests suggested that we have failed to reject the null hypothesis. Thus, there was not enough evidence to support the claim that there is higher insect activity after rain compared to sunny weather.

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Appendix

	Grass field near the Ponderosa buildings		Patch of soil beneath a maple tree	
	Sunny	Cloudy after rain	Sunny	Cloudy after rain
1	9	12	8	15
2	5	5	12	8
3	7	9	4	4
4	7	10	11	19
5	3	3	5	7
6	4	2	11	19

Table 1. The number of insects observed under two weather conditions at different locations