

DO SPOTTED LANTERNFLIES HELP OR HURT THE ENVIRONMENT?

to

The Ohio Academy of Science

by

Maya L. Estrada

3427 Indian Road

Ottawa Hills, Ohio 43606

15 Years of Age

Catelin R. Hawkins

2907 Hardale Blvd

Ottawa Hills, Ohio 43606

16 Years of Age

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Research Supervisor: Dr. Kreischer Gajewicz

Ottawa Hills High School

2532 Evergreen Rd

Ottawa Hills, Ohio 43606

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Abstract

The simple addition of a plant or animal may be fatal to an environment, leading to a declining population of vital species in an ecosystem. Ohio is home to a plethora of species that have endangered populations but also is full of invasive species including the spotted lanternfly, this sap-sucking insect has spread across parts of the United States and into Ohio. When the cooler months begin, countless eggs are laid which will then expand their population. They will fall into the soil and will eventually decompose into organic matter. The soil throughout Toledo is relatively neutral due to the presence of limestone in the subsoil. The hypothesis developed was if there is a higher population of spotted lanternflies, then the pH of the soil should be between 7.0 and 7.5. The goal is to test multiple sites where there is a high population of spotted lanternflies in hopes to see a slight change in the pH of the soil. The hypothesis is tested by using a pH testing kit and taking multiple samples from each site, then finding the average to prevent outliers in the data. The results showed the pH of an infested area was 7.2, but the controlled samples were exactly 7, this means that the spotted lanternflies have the possibility to alter the pH of soil. The results concluded in favor of the developed hypothesis, the subtle change in pH lead to the hypothesis being accepted.

Introduction

In 2012 the first discovery of an insect native to Asia made its way to the United States, but do not let this vibrant insect deceive you from its true nature. By 2014, the first infestation was discovered in Pennsylvania, they were believed to have gotten into the United States by hitchhiking onto cargo that was transported from China, India, or Vietnam. Spotted lanternflies are harmful because their sap-sucking mouths harm plants by their waste products that have a higher risk of fungal disease. They are able to reproduce very quickly; they can lay their eggs almost anywhere outside. By the time things were being transported out of Pennsylvania, it was too late. The spotted lanternfly had increased its range from only Pennsylvania to nearly all of eastern America, including Ohio.

An invasive species can be anything, it does not need to be an animal like the spotted lanternfly. Anything that is not native to the local ecosystem is considered invasive, Northwest Ohio is home to many invasive species such as honeysuckle, sea lampreys, zebra mussels, and spotted lanternflies are the most prominent invasive species in the area. Furthermore, the spotted lanternfly is not just invasive to the United States, but also to South Korea.

Now what do spotted lanternflies actually do? This small insect from Asia sucks the sap out from plants such as maple trees, grapevines, willow, birch, and other fruit trees. But they are most commonly found feeding on Trees of Heaven and maple trees in the local area. When they feed off of something, they leave a sugar, sticky substance behind that attracts other insects. The substance is called honeydew, when it is left behind it promotes sooty mold growth. Sooty mold growth appears on leaves and the base of the plant, it looks like black spots on the leaves.

Finding the pH of soil can be very helpful in determining the solubility, almost all nutrients that plants need come from the soil. There are many factors that contribute to having a healthy pH in the soil including, decomposition of organic matter, as well as snow or rain. Organic matter can include bacteria, fungi, and dead animals or insects. Spotted lanternflies will drop out of trees when the weather begins to cool down, but they are also physically removed by humans when they are in sight. It is encouraged by local news stations to step on them.

This project is a way to measure if anything beneficial could be gained from spotted lanternflies, specifically in the soil where they fall when the cooler months begin. The planned outlook is to see if there would be a change in pH of the soil where there were large populations of spotted lantern flies.

Methods and Materials

Method: Sampling soil from areas with high amounts of spotted lantern flies

- Taking three soil samples from each location to prevent outliers
- Taking control samples to use as a reference

- **Materials:**

- Luster and Leaf rapi-test soil testing kit
- A shovel
- A ruler
- Distilled water

Question:

Hypothesis: If there is a higher population of spotted lanternflies, then the pH of the soil should be between 7.0 and 7.5.

Procedure:

1. Take out Luster and Leaf Rapitest soil testing kit
2. . Remove the cap from the green comparator. Make sure the color chart (film) is in place.
3. Fill test chamber to soil fill line with soil sample.
4. Holding the capsule horizontally over the test chamber, carefully separate the two halves of the green capsule and pour powder into the test chamber.

5. Using the dropper provided, add water (preferably distilled) to the water fill line.
6. Fit the cap onto the comparator, making sure it is seated properly and caps tightly.
Shake thoroughly. 6. Allow soil to settle and color to develop for about a minute.
7. Compare the color of the solution against the pH chart.
Note: Inaccurate measurements can skew the results.
8. Record Data in Table and Repeat

This project is a way to measure if anything beneficial could be gained from spotted lanternflies, specifically in the soil where they fall when the cooler months begin. The planned outlook is to see if there would be a change in pH of the soil where there were large populations of spotted lantern flies.

Presentation of Data and Results

Figure 1- Table

	Sledding Hill	Hawkins House	Ottawa Hills High school	Control	control 2	control 3
Trial 1	7.3	7	7.2	7	7.1	7
Trial 2	7.2	7.5	6.5	7.2	7.1	7
Trial 3	7	7.2	6.8	6.8	7.1	7
Mean	7.166666667	7.233333333	6.833333333	7	7.1	7
std dev	0.15	0.25	0.35	0.20	0.00	0.00
SEM	0.07	0.11	0.16	0.09	0.00	0.00
2 SEM	0.14	0.23	0.31	0.18	0.00	0.00
Plus 2 SEM	7.30	7.46	7.15	7.18	7.10	7.00
Minus 2 SEM	7.03	7.01	6.52	6.82	7.10	7.00

Figure 1: Average soil pH at infested and non-infested sites. The Table represents the average pH level of the soil at three infested sites (Sledding Hill, Hawkins House, Ottawa Hills High School) and three non-infested sites (Control 1, Control 2, Control 3).

Figure 2-Bar Graph

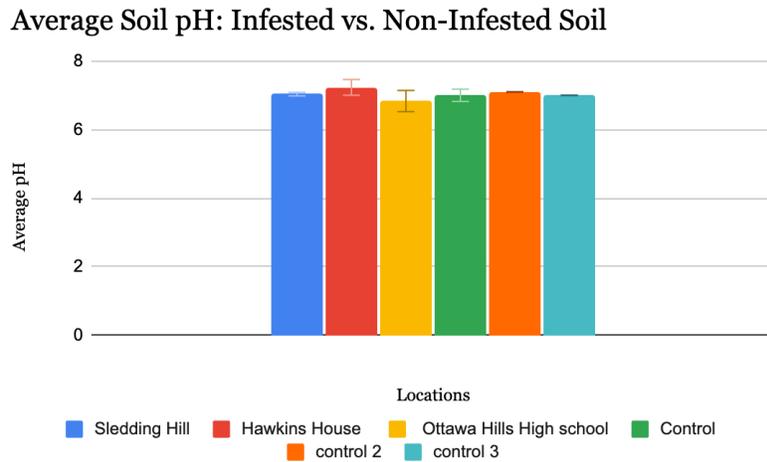


Figure 2: Average soil pH at infested and non-infested sites. The bars represent the average pH level of the soil at three infested sites (Sledding Hill, Hawkins House, Ottawa Hills High School) and three non-infested sites (Control 1, Control 2, Control 3). The error bars represent the range of the three trials.

In Figure 1, The table shows 6 different sites that include 3 infested sites and 3 uninfested control sites over 3 trials. The infested sites all had means close to neutral around 6.8-7.23. Ottawa Hills High School had the lowest average pH of 6.8 and “Hawkins House” had the highest pH of 7.23. There was little difference between the three control sites pH which ranged from 7.0-7.1. Throughout all sites the pH remained in a range of 6.5-7.5, there were outliers seen in the data. The high school had a much more acidic pH compared to the control sites as well as the infested sampled sites.

In Figure 2, The Bar Graph shows 6 different sites seen as separate bars that include 3 infested sites and 3 uninfested control sites over 3 trials the same as Figure 1 but, with error bars that showed the range of the trials. The Bars for all sites are around pH of 7 displaying the pH of soil from infested and noninfested sites have neutral soil.

Analysis and Results

These results suggest that the changes in pH levels are likely due to the presence of spotted lanternflies in the environment. The addition of spotted lanternflies to the soil each year has increased the organic matter in the soil, allowing for a more balanced pH. The first set of data at the Sledding Hill had a pH of 7.17, it was slightly higher than the control samples. The Hawkins House also had a pH that was higher than the control samples, but the samples taken from Ottawa Hills High School had a much lower pH than the control samples.

The process of finding the pH levels in each sample site involved multiple steps. Each site had three samples taken from the soil, the main purpose being to prevent any outliers in the data. Once there were three, the mean or average was calculated in each site, the calculation involved adding all the results for each size and then dividing by the number of samples.. Standard errors of the mean were also calculated, which is calculated by using the standard deviation of the results and dividing by the square root of the sample size. It allowed a range of numbers that were similar to the calculated results to also be possible results.

The hypothesis was if there is a higher population of spotted lanternflies, then the pH of the soil should be between 7.0 and 7.5. The data collected mostly supported the hypothesis, two out of the three infested sites had pH levels that were over 7.0. A study about soil pH in Ohio had pH levels that ranged from 6.7 to 6.8, it also mentions how the state has different pH levels depending on the location. In the western area of

the state, the pH tends to be less acidic than in eastern Ohio because the west has a higher concentration of limestone in the soil. This would explain why those results differed from the ones conducted in Toledo, having a higher pH was expected.

These results were likely obtained because the spotted lanternflies had been present in the environment for around five years before this experiment was conducted. They had slowly decomposed into the soil, the active addition to them into the soil had likely affected the pH of the soil.

The outlier in the data was likely due to environmental factors that could not be controlled, including the current weather that was present during the data collection. When the soil was being collected there had been snow on the ground, but the surrounding areas such as the parking lot and walking paths had been salted. This is a likely reason why the sample taken from the school had a pH level of 6.83.

Conclusion

Overall, the data collected shows that there is a correlation between the pH of soil and the presence of spotted lanternflies. The hypothesis was accepted because the control samples had a slightly lower pH than the sites that were sampled. However, the presence of a very prominent outlier may counter the validity of the hypothesis if more data is to be collected, the prior research stated that the pH of soil in Ohio ranges from slightly acidic to neutral depending on the location. Furthermore, the amount of organic matter may not have been equal in each site. Before the experiment was conducted, the participants in the project had expected the hypothesis to be accepted.

Discussion

The experiment if it could be done again, instead of getting data during the later months where snow could skew the results of the pH. Furthermore, the soil from some sites may have been from other states that may have a different pH than the local pH. Beyond the classroom, this research project can allow people working with soil to know and understand the impact of spotted lanternflies on their soil. To extend the project, other variables in the soil can be tested, including potassium, nitrogen, and phosphorus. A study done by Ohio State performed a similar experiment by measuring the soil health across Ohio, this would differ from the extension of this project because the extended experiment would compare the soil health of infested and non-infested areas.

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