The Role of Temperature, Relative Humidity, and CO_2 Concentrations on the Biodiversity of Lichens at Brookside County Park Sayville

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RISE
TIER #1

Question

Do variables such as temperature, relative humidity,and CO_2 concentrations affect the biodiversity of lichens in a specific area?

Hypothesis

Temperature, CO2 levels, and relative humidity do affect the biodiversity of lichens.

*Null hypothesis:Temperature, CO2 levels, and relative humidity don’t affect the biodiversity of lichens.

Background Research

Lichens are composed of a fungi and an algae put together that live in a symbiotic relationship. They can live in very harsh environments, but the regions that the lichens grow in can affect the amount of lichens in that area. The lichen biodiversity can be affected by the temperature, carbon dioxide concentrations, and the relative humidity in that given area. If a specific quality is not present in an atmosphere certain lichens will not be able to grow in that area. The DNA barcoding can be used to confirm where some lichens are present and where others are not. To abstract the lichen from a given surface scrapers and picks will be used to remove an area of the lichen. This sample will then be frozen until the extraction process is able to take place. There is going to be testing at the lichen sampling site for the temperature, CO_2 concentrations, and relative humidity in that given area to analyze for further data on how it can affect the biodiversity in that area.

Background Research

Lichens can be found in three different forms. There are Crustose, Foliose, and Fruticose lichens. The Crustose have a crumbly texture and are found more on flatter surfaces. Foliose lichens usually resemble leaves and are very commonly found on rocks. Fruticose lichens can resemble plants. Lichens are usually a green/gray color can can look a lot like moss, but they are very different. Moss is usually recognized as a plant. Also, lichens can be used to determine the climate around them while moss can not. Moss is able to perform photosynthesis through it's chloroplasts while lichens do not contain chloroplasts except for in the algae part of the lichen. The fungus part of the lichen is there so protect the algae so the lichen can still use the photosynthesis process in a harsh environment. Lichens are known to absorb carbon dioxide in the environment through it's thallus. This can help the surrounding area of the lichen to prosper.

Materials

- PCR tubes
- Picks
- Scrapers
- Sterilized Tweezers
- Collecting containers
- Micropipettes
- A centrifuge
- A heat block
- Staining dye
- A vortexer
- A UV transilluminator

Variables

Dependent Variables:

- Temperature
- Relative Humidity
- Pressure
- Sample Size
- CO2 Concentrations
- UV levels

Each of these variables were measured at each sampling site to determine the species of each lichen.

Independent variables:

- The geographic location of each of the lichens

The location of the lichens stayed the same as they were all found with within Brookside County Park.

Procedure

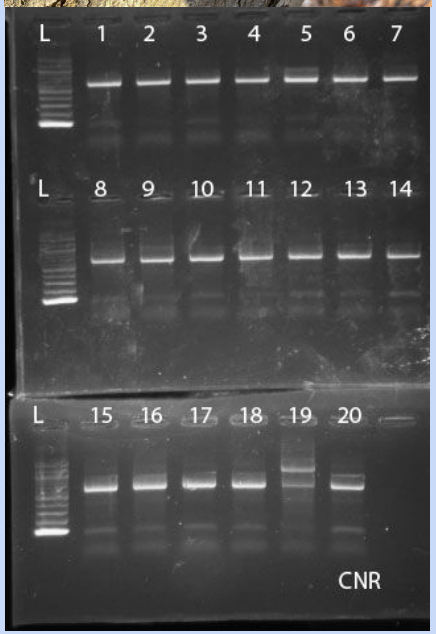
Lichens were gathered at Brookside County Park in various areas to get more accurate results. The lichens were collected near water, rocks, and trees. Before the removal of each lichen testing took place to determine relative humidity, temperature, and CO2 concentrations. Also, the latitude and longitude data was collected to help mark exactly where the lichen was located on a digital map. The size of the lichen sample was taken as well as the pressure and UV in that specific area. A scraper was then used to remove the lichen from the given surface. About 5 pictures of each lichen was taken, all from different angles. Each lichen was then placed into separate envelopes containing the data that was taken for each lichen. All 20 of the lichens were then brought back to the lab for the isolation and amplification process. The DNA was then put through the gel electrophoresis process. Once the DNA was sent to Cold Spring Harbor the results came back inconclusive so the isolation and amplification process had to be redone.

Results

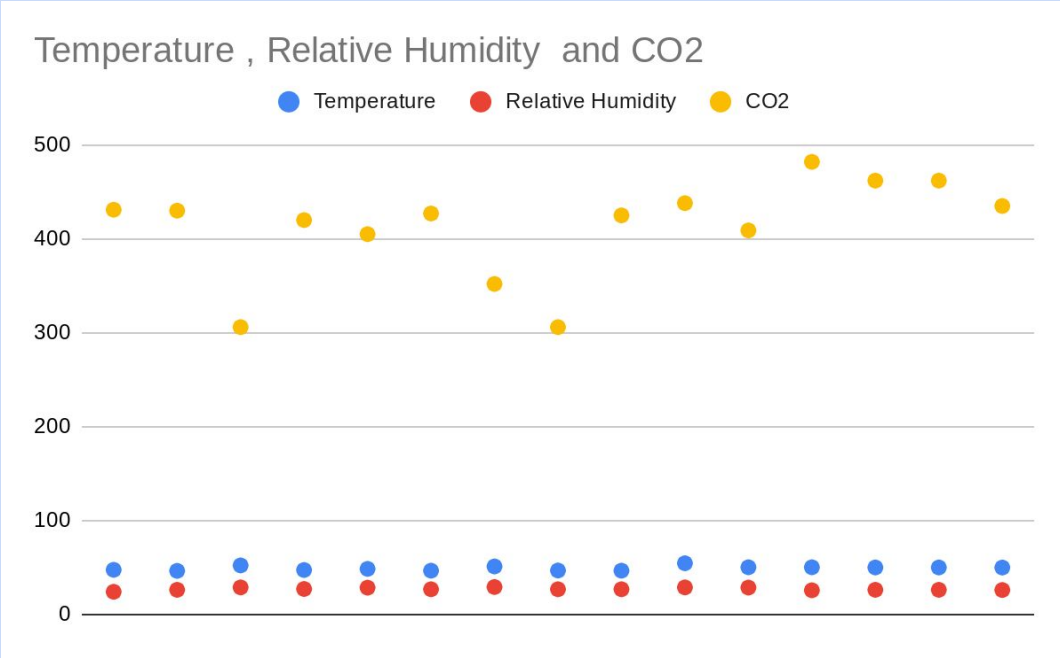
After the DNA barcoding took place the results had come in and were uploaded into a database used by may different labs. This is called DNA Subway. Out of all 20 samples that were processed there were only three different species of lichen that were found in Brookside County Park. Out of these twenty lichens, 18 were a lichen called Eppococcum. The Eppicoccum lichen is known to grow in area with a higher relative humidity and near areas with multiple multiple water sources, which Brookside County Park did contain. Since the results came back that majority of the lichens were Eppicoccum this does prove that temperature, relative humidity, and CO2 concentrations have an effect on the biodiversity of the lichen. Only the Eppicoccum lichen was able to grow in this area because it was the only type of lichen that was able to live in an area with these levels of temperature, relative humidity, and CO2 concentrations. The other two species that were found was the Physica Stellaris lichen and the other was not a lichen, but it was a fungus. This fungus was an Endophytic Fungus. The Physica Stellaris and Endophytic Fungus are both known to grow in open forest areas.

Research Notebook

1.Before the lichen was removed off of each surface it was measure to obtain the sample size data.



2.After redoing the process of isolating the DNA again it was put through the electrophoresis process again and these were the results. As shown majority of the samples had very similar DNA based on how far it moved down the gel.



3.The graph above shows how similar the temperature, relative humidity, and CO2 concentrations were to one another at each sampling site which which would explain why 18 out of the 20 samples were Eppicoccum.

Conclusions

The results that were found through this experiment were expected as majority of the lichens that were found were the Epicoccum. This is because it is one of the only lichens that can grow in this specific environment with the temperature, relative humidity, and CO2 concentrations being at this level. This experiment proved the hypothesis correct that these factors do affect the biodiversity in the area. All different lichens have different specifications for the environment they can grow in. During this experiment there were some complications that arose. Some lichens were harder to remove from the surface they had grown on. This would mean that more of one lichen could have been collected than any of the others. One of the other issues that was found during this experiment was that when injecting the DNA into the gel for the gel electrophoresis process to occur, the DNA sequences were very hard to read because of the amount of dye that was mixed with the DNA. This experiment helped to how biodiversity of a species can be affected by the factors around it.

Future Work

DNA is a molecule that contains genetic information to keeps a living organism in a state of homeostasis. The DNA can be affected by the genes that are from the mother and the father. This leads to internal and external differentiation of the embryo. The issue with genes is that they are easily mutated by many factor in the environment. For example, a cell can turn cancerous from the air pollution in the atmosphere. This cancer can replicate throughout the human body which can be fatal. Some DNA from different specie can be very similar to each other such as zebrafish and humans. Zebrafish share 70% of their DNA with humans. Zebrafish are able to reproduce at a very fast rate which makes them easier to use for medical testing. These zebrafish can be used to figure out many leading causes to genetic mutations and ways to stop them from occurring. By exposing the zebrafish to toxins or chemicals that are in the atmosphere, it can show how fast a zebrafish is impacted and how fast the genetic mutations occur.experimenting with the zebrafish can also apply to humans in the sense of reaction rate to a toxin. DNA barcoding will be used in this process with the same procedure performed.

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Acknowledgements

I would like to thank Cold Spring Harbor Laboratory, Anthony DeAngelis, and Jennifer Byrnes for helping this experiment to take place.