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Plant Algae Ecosystems

Arturo Hernandez
Parkland College

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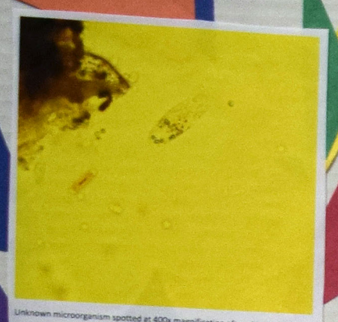
Bio 141



Unknown microorganism spotted at 400x magnification after algae was freshly extracted.

Introduction

At home I have a sealed terrarium with two plants, a *Phlebodium aureum* rabbit's foot fern and a *Soleirolia soleirolii* baby's tears plant. In small glass jar I have a *Crassula Calico* kitten strings plant that also features a false bottom. The terrarium and glass jar planter feature a false bottom in which water collects and slowly evaporates. A false bottom can be created by putting rocks or in my case, small clay pebbles, at the bottom of the planter or terrarium. The substrate is placed on top of this layer of rocks and then plants are planted in the substrate. When you water the plants, the water filters through the substrate and into the rocks or clay pebbles. This creates well drained soil and prevents the plants from sitting in stagnant water.

Algae started growing in the false bottom. Algae is at the bottom of the food chain. It the main provider of food for small aquatic animals ("Algae"). Is this algae co-dependent with the plant and substrate, or can this alga survive on its own?

I have extracted some algae from both planters and examined the algae under a compound light microscope. It was very surprising to find a very diverse ecosystem of microbes that lived alongside the algae. This ecosystem of microbes was a found in both planters. This diverse ecosystem of microbes may also be co-depending with the plant and can only live with this unique environment. Since both planters are made of clear glass, the glass allows sunlight to filter in.

Experimental Question

The experiment will focus on the algae. We will see how the type of light will affect the way they grow. What kind of light conditions is necessary for the algae and microorganisms to survive? While the microorganisms aren't the focus, we can still observe and see what happens along with the algae. Can the biodiversity be sustained within an enclosed system without the plants and substrate?

Terrarium and small glass planter where algae were extracted. The false bottom was created using clay pellets. A layer of substrate was put on top with plants.

Experimental Design

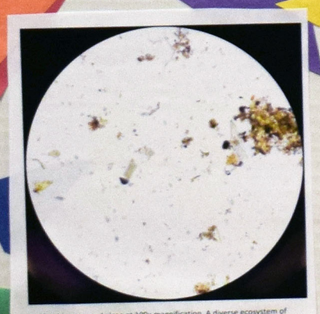
Algae was extracted from both planters and placed into petri dishes. This removed the algae from its unique environment. There is a total of 12 petri dishes used. To mimic sunlight, a 50W Full Spectrum LED Grow Light Bulb for plants and a Daylight (5000K) High Definition LED light bulb was used to light the algae sample.

Each grow light contains 6 small petri dishes; 3 will be from the terrarium and 3 will be from the glass jar. The lights will be on for 12 hours a day and I will see if there is any growth in the petri dishes. The petri dishes will also be sealed using Parafilm. This type of condition was sustained for about 6 weeks.

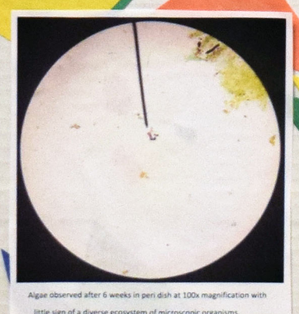
Troubleshooting / Errors in the Design

I needed to gather enough algae samples to fill 12 petri dishes. Since the glass jar was small, I could only extract small samples at a time. There was a time difference from when I extracted the algae to how long I was able to leave it under the grow light. All 12 samples of algae did not start this different growing condition at the same time. Some petri dishes were under the lights for 6 weeks, while 2 samples were under the light for about 4 weeks.

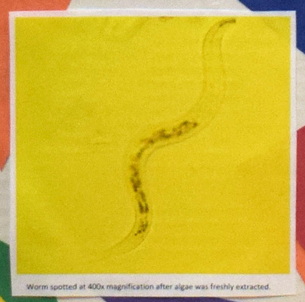
Another problem was that the parafilm was not sufficient in sealing the petri dishes. The water seemed to evaporate a little and water needed to be added to the petri dish. This water was regular tap water. Tap water is what was used to water the plant. However, this new fresh tap water did not filter through the plants and substrate. This new water may have contaminated the environmental conditions of the petri dish samples.



Freshly extracted algae at 100x magnification. A diverse ecosystem of microscopic organisms can be seen.



Algae observed after 6 weeks in peri dish at 100x magnification with little sign of a diverse ecosystem of microscopic organisms.



Worm spotted at 400x magnification after algae was freshly extracted.

Unknown microorganism spotted at 100x magnification.

Unknown microorganism spotted at 400x magnification after algae was freshly extracted.

Results

After the 6-week time, several samples from the terrarium and glass jar were examined under a light microscope. These samples were from both the 50W Full Spectrum LED Grow Light Bulb for plants and a Daylight (5000K) High Definition LED light bulb. Samples from both types of light looked the same in the number of algae that was still present.

The microscopic diversity did suffer. In the initial observation of the algae we could see that there were many rapidly moving microorganisms. At a 100x magnification, we had a good sixed field of view. A short 3 second video was captured in this view. We were able to observe around 20 rapidly moving organisms. These organisms included two worm-like microorganisms. We could also see very small but very fast-moving organisms that zoomed across the field of view.

After 6 weeks, we looked at the samples. There was a big decline of microscopic organisms' present. We created another 3 second video of the microorganisms under 100x magnification. At this field of view, only 4 rapidly moving microorganisms where identified. This was a very big decline from the 20 organisms that was initially observed. One of the survivors was a worm that may be a nematode. This type of worm was also identified when the algae samples were freshly extracted.

It seems the algae was not dependent on the substrate and plants. It could survive purely on light. However, the microorganisms may have been dependent on the substrate and plants above. The water that filtered through the soil and plants may have carried nutrients and food with it. This supply that the water moved in must've provided vital elements for the population of the microorganisms. Since there was a significant decline in the microorganism population, we might conclude that the organisms were running out of food or resources. There was no flow of water present, except for the few drops of tap water that was added into the petri dishes to keep it from drying out. This was just plain water and it was not filtered through the plants and soil.

Microscopic algae observed after 6 weeks in petri dish at 100x magnification.

All that can be seen is algae.

Conclusion

The algae seemed to be unaffected by this new environment. The algae stayed green and clumped together. It seemed to settle after a few weeks. The algae survived on both kinds of light. Under the microscope, algae seemed to look like it was in the same condition before and after sitting in the petri dishes for 6 weeks.

The algae samples suffered a rapid decline of microorganisms. The same organisms were spotted after six weeks; however, it was harder to find them. They were located after a few minutes of shifting the stage. When the algae were first extracted from both planters, it was very easy to spot many kinds of organisms.

Future direction

In future experiments, we can look at the benefits that plants can get if algae grown under the substrate. In a glass planter or terrarium, sunlight penetrates though into the false bottom. This false bottom separates the algae and the substrate. However, we can look and see if the algae affect the nutrients levels in the substrate.

Plants depend on nitrogen, phosphorus, and potassium (NPK) to thrive. Algae regulates the nitrogen level in its environment depending on when it is exposed to sunlight (Xiaofeng et al. 1-2).

Thriving algae observed after 6 weeks in peri dish with little sign of a diverse ecosystem of microscopic organisms.

Works Cited

"Algae." Philip's Encyclopedia, 1st ed., Philip's, 2008. Credo Reference, ezproxy.parkland.edu:443/login?url=https://search.credoreference.com/content/entry/philipency/algae/0. Accessed 03 Nov. 2018.

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A full online album of pictures and videos can be seen at: https://photos.app.goo.gl/xDFripNhk794V2Gs7