Local Phycoprospecting for Filamentous Alage

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Abstract

Algae are a crop whose high reproduction rate makes them ideal as a feedstock for bioenergy via anaerobic digestion, or as nutritional supplements. The primary benefit of algae compared to other crops is their rapid reproduction rate, which is hours instead of days or months. Additionally, algae can be grown in a wider range of areas than traditional crops and can serve multiple functions at once. For example, algae may be used to aid in wastewater remediation at the same time as the algal biomass is used to produce biofuels. Algal productivity can vary greatly based on retention time, season, nutrients, temperature, and species. Many of these factors are intrinsically tied with geographical location. As such, this study focuses on phycoprospecting for algae in the local area, with the expectation that these algae are adapted to and well suited to local conditions. Filamentous algae, in particular, are not commonly cultivated. However, they show promise as an alternative to the standard cultivation of microalgae. Filamentous algae are more easily separated from the cultivation medium in which they are grown by means of filtration and are a readily usable product. In this study, samples of indigenous algae were collected from local sites and locations recorded via photo-metadata. The samples were analyzed and filamentous algae genera identified via light microscopy. The study resulted in the acquisition of local *Oedogonium*, *Ulothrix, Hyalotheca*, *Mougeotia*, *Microspora* and *Spirogyra* cultures that can be used for future cultivation and experimentation.

Introduction

The sampling locations were chosen with the understanding that while some factors still varied, i.e. volume of water body and water quality/nutrients, the sites would share a general location and the geographical climate could be considered relatively uniform. The sites were initially seen to have visible filamentous growth to at least some extent, showing that the algae were well adapted to the local climate and would be reasonable choices for further cultivation and study **[1,2]**.

All the algae obtained have been at some point cultured and all have been cultivated to at least a laboratory capacity **[3]**. Most of the cultivations though have been mixed-culture cultivations in which the algae were grown in tandem with a variety of other algal genera **[3,6]**. Of these many have been used for bioremediation and/or for biofuel production **[4,5]**.

Objective

The primary objective of this study was to collect a variety of filamentous algae from local water sources. The intent behind this objective is to gather algal strains for cultivation that are well adapted to the local environment.

Methods

Acquiring samples:
The samples were all collected from local water sources during the early afternoon. The collection areas were all at the waters edge and samples were only collected where filaments were visible. While some of the visible filaments acquired were blue-green algae such as *Oscillatoria,* these were discarded and excluded from the study.

Light Microscopy:
The algae samples were prepared via pipetting.
The samples were then analyzed via light microscopy under 100x, 250x, and 400x magnification. While magnified, they were examined for identifying features like oogoniums and chloroplast structures **[7,8]**.

Site Descriptions:
Site 1: This site is by the shore of a small retention pond at a local apartment complex. The water is murky brown and smells slightly of decay. The shore is shaded by trees and the water littered with organic debris while the interior gets sporadic patches of sun. Overall it is stagnant.

Site 2: This site is a small cove of Lake Alice by the Baughman Center. It is largely shaded but still connected to the main lake and filaments here tended to affix themselves to plants.

Site 3: This site while near site 2 has almost perpetual sun, weather permitting, as it is a small peninsular area that lacks most tree cover.

Site Descriptions:
Site 4: South side of Lake Wauberg. This site serves as a largely undisturbed counterpart to site 5. It has moderate light.

Site 5: North shore of Lake Wauberg. This site was chosen as it has a larger amount of disturbance than some other sites due to frequent use by swimmers and boaters. The area has variable light exposure due to tree cover.

Site 6: Overflow at the observation boardwalk from flooding at Payne's Prairie that has persisted since a hurricane in the previous year. It was chosen as it is a much smaller scale body of water that is primarily stagnant but has some periods of heightened ecological change, i.e. overspills from the preserve.

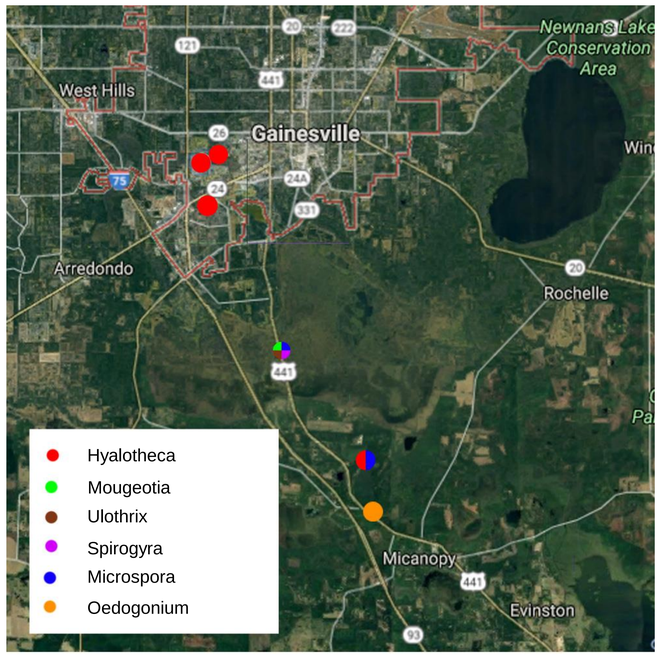

Figure 1. Map depicting the local area with colored circles corresponding to the sites where algae were obtained. The colors correspond to the genera acquired at each site.

Results

Figure 2. *Ulothrix* obtained from site 6, Payne's Prairie (400x).

Figure 3. *Mougeotia* obtained from site 6, Payne's Prairie.

Figure 4. *Spirogyra* obtained from site 6, Payne's Prairie. The genera is evident by the helical arrangement of choloroplasts.

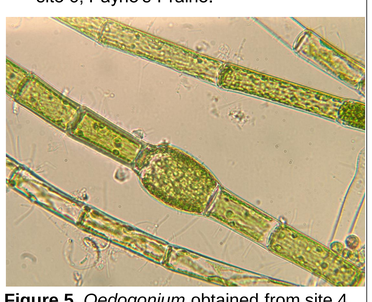

Figure 5. *Oedogonium* obtained from site 4. The genera is evident by the presence of the oogonium that can be viewed above.

Location	pH	Temperature °C	Conductivity µS	Min/Salt ppm	Total Dissolved Solids ppm	ORP mV
Site 1	6.97	31	79.05	35.89	217	49.38
Site 2	7.73	33.8	302.5	142.3	171	193.2
Site 3	8.25	33.8	298	140.4	135	190.2
Site 4	7.86	32.2	106	48.94	65.66	127
Site 5	8.33	34.7	98.67	45.71	61.85	123
Site 6	8.3	37.7	115.8	53.38	71.71	146

The result of this study was the collection of *Hyalotheca, Mougeotia, Microspora, Oedogonium, Spirogyra* and *Ulothrix* from local water sources. The largest diversity was seen in site 6, with site 5 offering the second highest diversity of filaments. These sites had the highest temperatures and decent sun exposure especially in comparison to the other sites. In terms of other factors, they appeared to show moderate results.

Figure 6. *Microspora* obtained in sites 5 and 6. Key features are the very square cells and H-segments between cells.

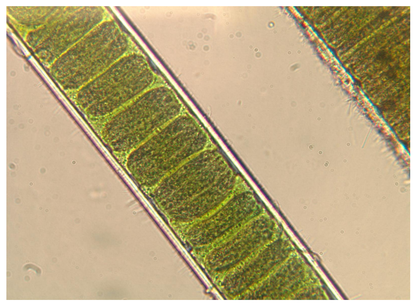

Figure 7. *Hyalotheca* was observed in sites 1,2,3, and 5. The genera was determined by the large sheathe around the filaments and the slight divots showing constrictions between cells.

Conclusions

This study identified and acquired filamentous algae of the genera *Oedogonium, Hyalotheca, Microspora, Ulothrix, Mougeotia,* and *Spirogyra,* from local sites. These algae are expected to be suitable candidates for use in future cultivation experiments. The study intends to isolate them further. Once suitably isolated, the genera will be grown.

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