Seasonal variation in the phytoremediation potential of *Pontederia crassipes* and its associated microbiota

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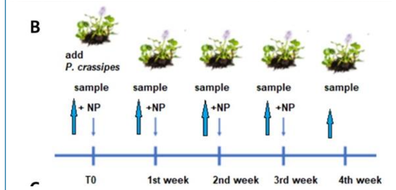
Introduction

Eutrophication is a worldwide water quality issue characterized by enrichment nutrients such as N and P in water bodies. A promising and sustainable way to mitigate eutrophication is the phytoremediation of nutrients by aquatic plants. A potential species for phytoremediation is the water hyacinths (*Pontederia crassipes*) which, together with its root microbes, play a role in water restoration. We compared the nutrient removal efficiency by *P. crassipes* and the composition of its root microbial community over a seasonal cycle.

Methodology



Each mesocosm (3000 L) received 30 plants. It was added weekly in the first mesocosm NPK 10-10-10 to increase the soluble phosphorus concentration up to 400 µg/L.

Water samples were analyzed for the following parameters:

- Conductivity and pH;
- Nutrients (P and N);
- Dissolved oxygen
- Temperature
- Chlorophyll-*a* concentration

The dataset was analyzed by Principal Component Analysis (PCA) to assess any seasonal difference in the plant-driven water changes.

In addition, five plants from the first and the last mesocosm units were harvested weekly to assess the microbial community by examining the 16S bacterial rRNA gene.

Results

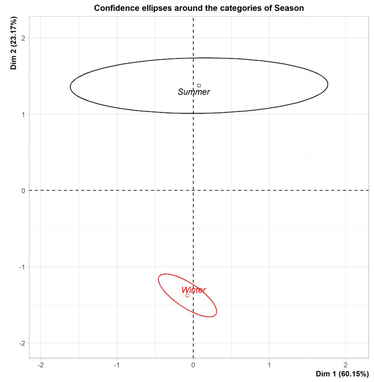


Figure 1. PCA including the physicochemical paramete of the water column, chlorophyll-a concentration ar macrophyte coverage of the mesocosm system summer and winter. Season determination ($p < 0.05$).

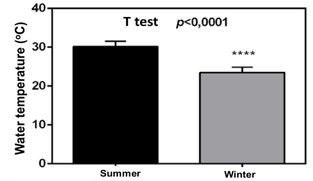


Figure 2. Water temperature in both seasons.

It was observed a higher removal efficiency in summer (53% of P, 17% of N) than winter (23% of P, 4% of N), and the physical-chemical parameters had distinguished values in summer and winter, manly related to water temperature (Figure 2). The main Orders identified were Chroococcales in summer and Bacillales in winter (Figure 3).

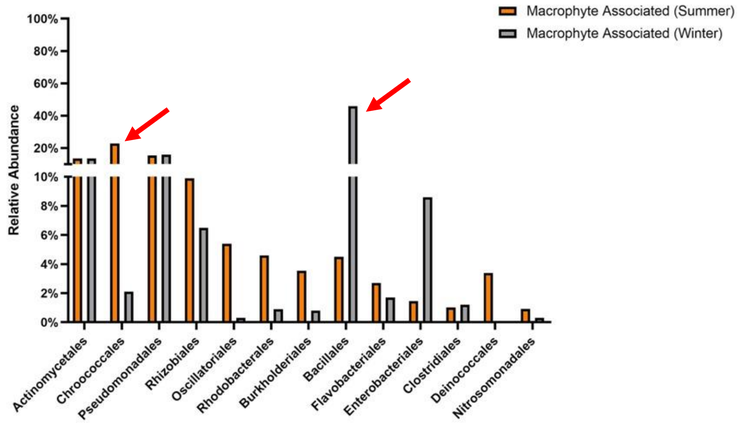


Figure 3. Relative abundance (%) of major bacterial orders in macrophyte associated communities in summer and winter. The represented orders corresponded to 90% of the community composition in both seasons.

Conclusions

Our results evidenced that seasonality may influence nutrients phytoremediation in water as well as plant microbial composition, which is probably a consequence of significant temperature variations. Therefore, although the water hyacinth plays a role in nutrients removal, its application must consider the seasonal variations.

Acknowledgments

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References

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