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Documenting Phenological Growth Patterns of a Novel *Hydrilla verticillata* Biotype

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Introduction

Hydrilla verticillata (L.f.) Royle is a non-native, invasive aquatic weed that has become widespread throughout water resources in the United States since it was introduced in the 1950's. Recently, a genetically distinct biotype of hydrilla was characterized in the US in the Connecticut River (Tippery et al. 2020) (Figure 1). Research on the biology and potential management of this biotype is extremely valuable for continued management of navigable waters of the United States.

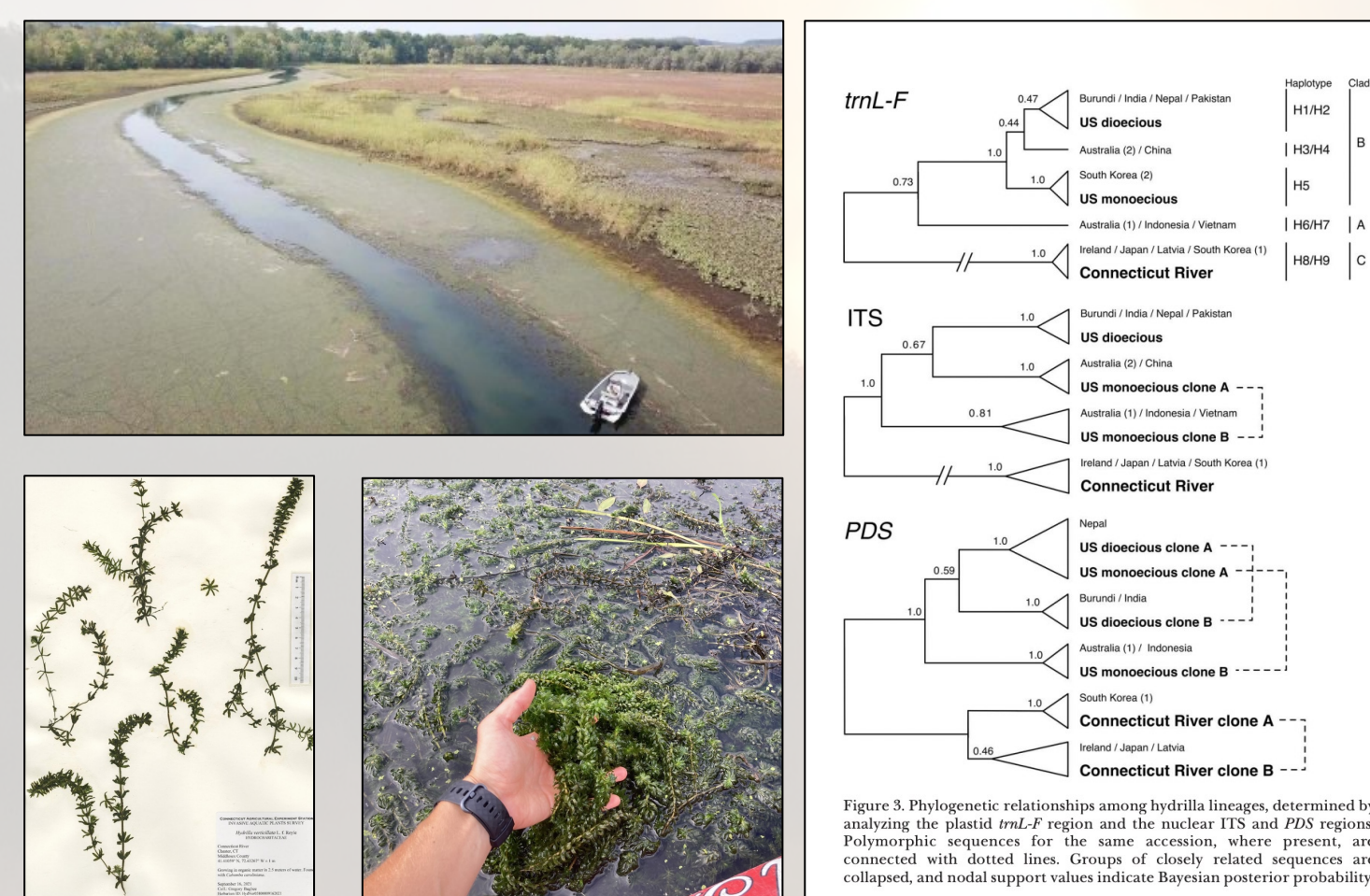
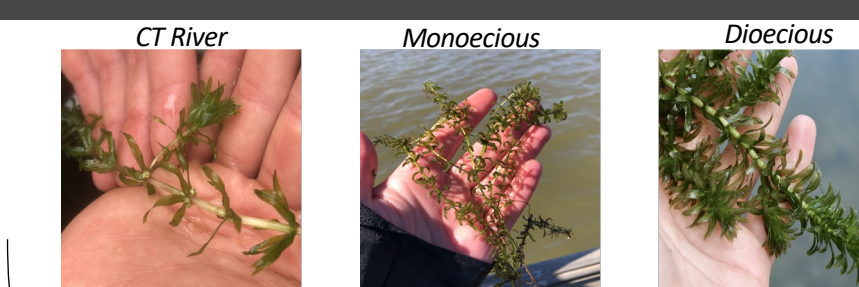


Image sources: Connecticut Agricultural Experiment Station
Figure 1: Documentation of hydrilla extent and abundance in the Connecticut River (left). Phylogenetic relationship between novel CT River Hydrilla biotype and other known hydrilla samples documented by Tippery et al. (2020).

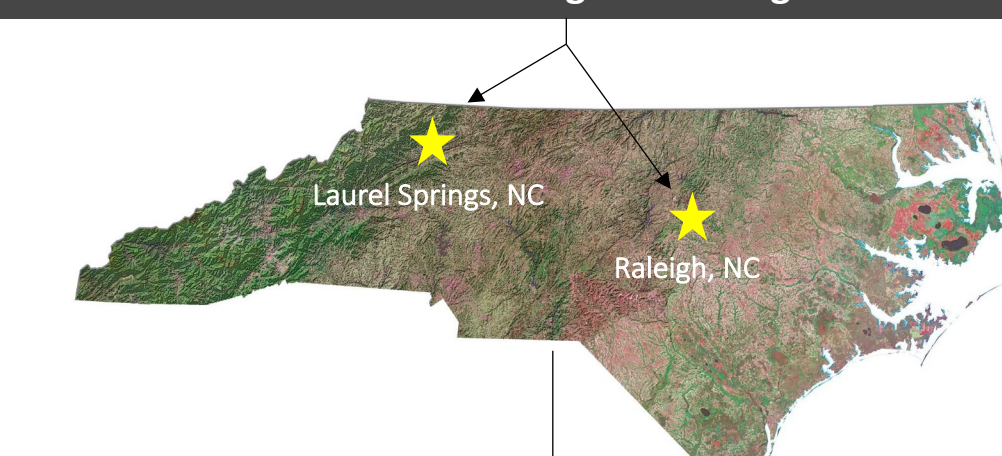
Methods

1. Vegetative propagules (tubers/turions) of each US biotype of hydrilla were allowed to sprout under greenhouse conditions. Biotypes included:
 - a. Novel Biotype ("CT River")
 - b. Monoecious
 - c. Dioecious
2. Sprouted propagules of equal size were planted in outdoor mesocosms at two sites with dissimilar climates (Raleigh and Laurel Springs, NC) at the beginning of the 2022 growing season.
3. One plant per biotype (x 4 replications) was studied and destructively harvested at 30, 60, 90, and 180 days after planting (DAP).
4. Vegetative propagules were collected at 180 DAP and were individually weighed and measured.
5. Collected data were subjected to statistical analysis in JMP Pro™ software.

1. Hydrilla collection and propagule preparation



2. Establishment under differing climate regimes



3. Comparison of morphology and phenology over time

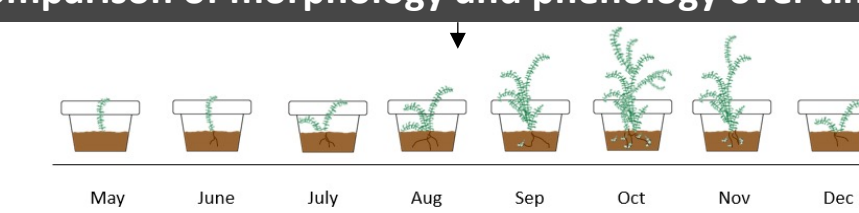


Figure 2: Schematic for project methods

Results

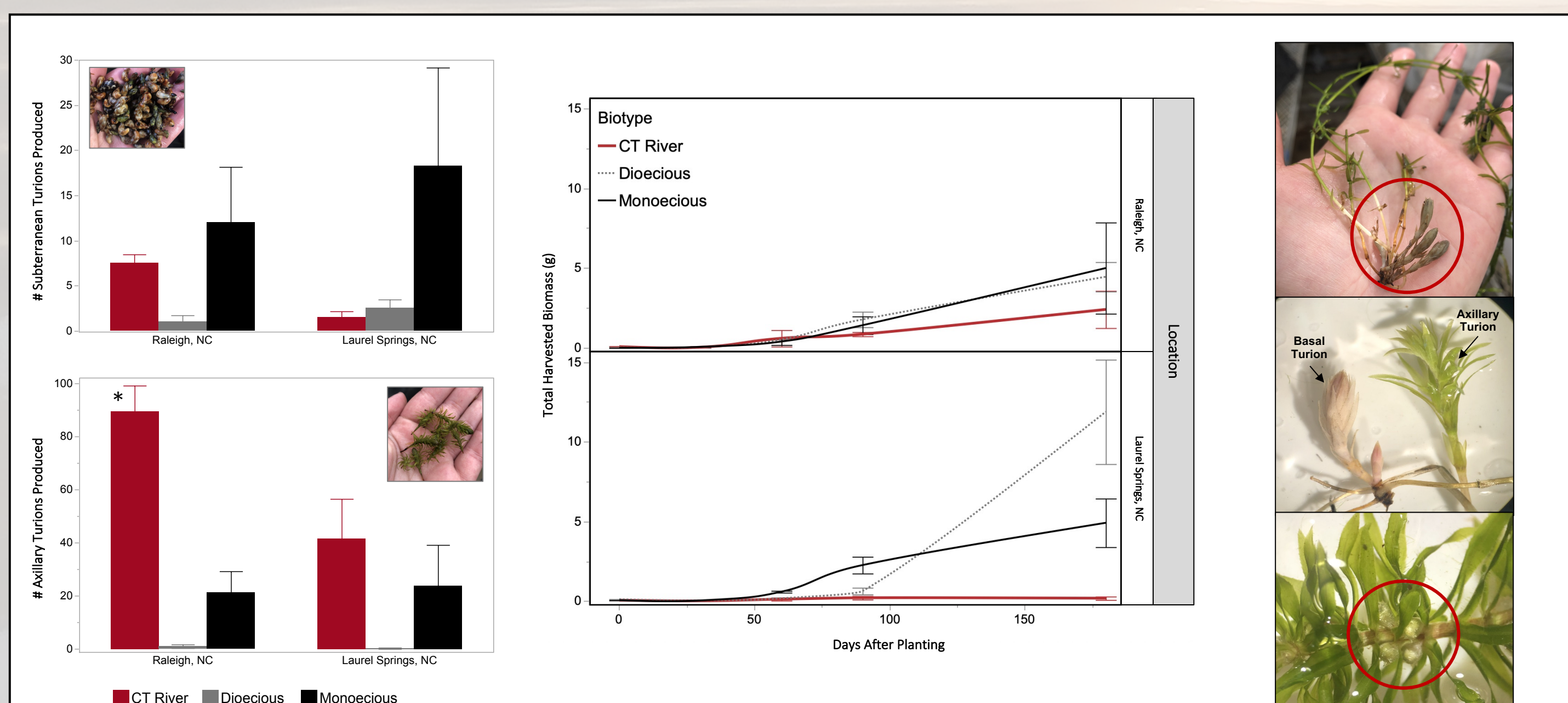


Figure 3: Comparison of subterranean turion (top) and axillary turion (bottom) production of hydrilla biotypes harvested at 180 DAP in Raleigh, NC and Laurel Springs, NC. Error bars represent \pm SE. Significant differences in means according to a Tukey's HSD test are marked by **.

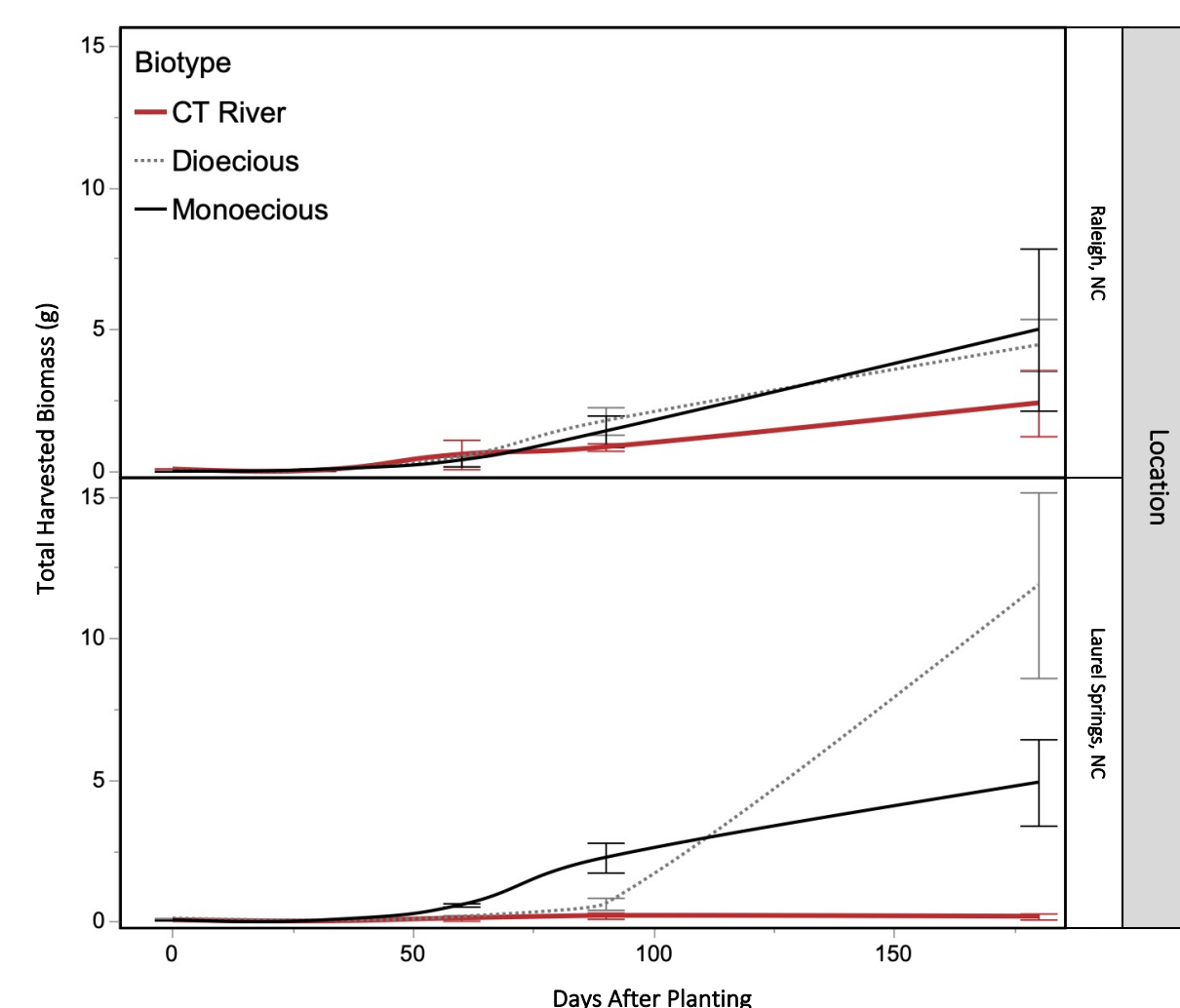


Figure 4: Biomass development of CT River, Monoecious, and Dioecious Hydrilla in Raleigh, NC and Laurel Springs, NC throughout the growing season. Error bars represent \pm SE.

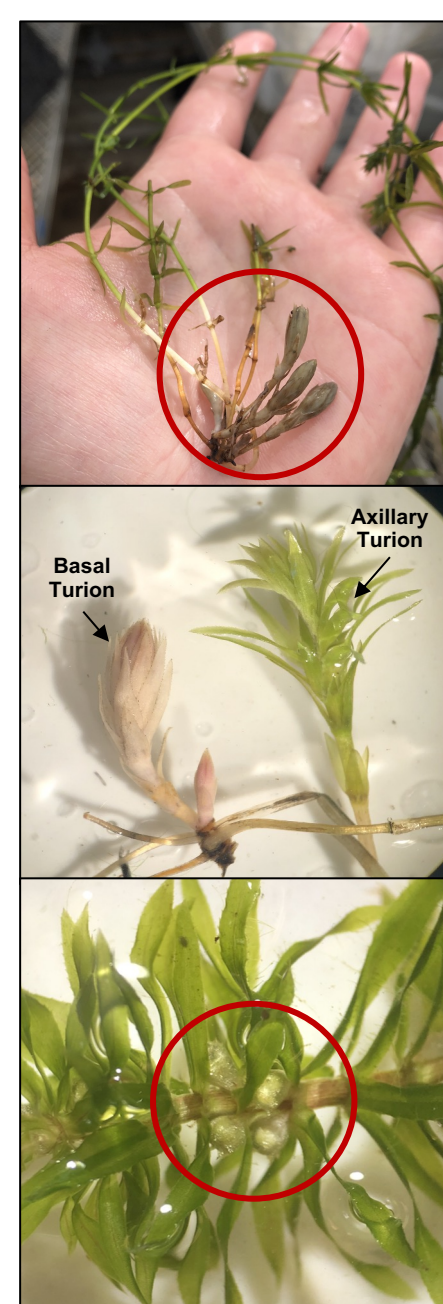


Figure 5: Morphological observations of the CT River hydrilla. Basal turions (top) and male flowers (bottom).

Conclusions

We've learned that the novel hydrilla biotype found in the Connecticut River:

- Can produce significantly more axillary turions than monoecious and dioecious hydrilla (Figure 3).
- Has slower biomass development when compared to other biotypes (Figure 4).
- Produces male flowers approximately 90 days after sprouting (Figure 5).
- Forms "basal turions" at the end of the growing season (Figure 5).

Next Steps

- Narrow down the environmental thresholds for major phenological events.
- Explore management options for CT River hydrilla through greenhouse-based herbicide trials.

Implications for North Carolina

Hydrilla is a noxious weed in North Carolina and the monoecious biotype has become widespread in many water resources throughout the state. Its management is costly and is often complicated. Through this work, we have confirmed that the novel biotype of hydrilla in the Connecticut River could survive in North Carolina under multiple climate regimes. Due to this, it is imperative that we continue to learn more about the ecology of this biotype and determine appropriate management options to mitigate the spread of this weed further throughout the United States.

Acknowledgements

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References

Tippery NP, Bugbee GJ, Stebbins SE. 2020. Evidence for a genetically distinct strain of introduced *Hydrilla verticillata*(Hydrocharitaceae) in North America. *J. Aquat. Plant Manage.* 58:1-6.