Curly Leaf Pondweed (*Potamogeton crispus*): Factors Controlling the Viability of Turions

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LSSURP Independent Research: Risk Analysis for Introduced Species and Genotypes

Introduction

Potamogeton crispus (curly-leaf pondweed) is an invasive aquatic macrophyte present in almost all of the United States. A winter annual, *P. crispus* crowds out the native plants, changes the ecosystem, and contributes to eutrophication. Although the plant itself can be controlled with herbicides, its turions, or reproductive buds, resist treatment. Because these turions can remain dormant for at least four years, the plant continues to sprout year after year. Turion sprouting must thus be controlled for effective long-term management.

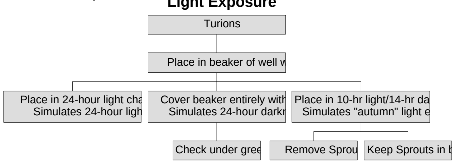
The effects of *P. crispus* on Minnesota lakes. In late spring and early summer, the plant covers the lake (left picture). Upon senescence (right picture), the plants decay and greatly contribute to algal blooms. (Newman)

We investigated the factors that contribute to survival and the sprouting of new (< 1 mo old) and old (> 11 mo) turions. Such predictors include light and temperature exposure, carbohydrate content, phenolics (tannins), and hormones (abscisic acid). The information will be used to further find ways to control *P. crispus*.

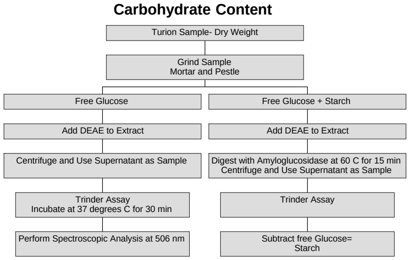
Methods

Turions were collected from Lake Sarah, Hennepin County, MN, in June from sediment (old turions) and July from senescing plants (new turions).

Light Exposure



Carbohydrate Content



P. Crispus turions, or reproductive buds. (James Johnson U of M))

Abstract

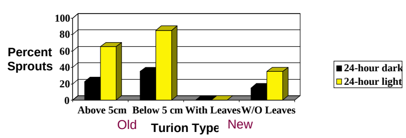
Curly-leaf pondweed (*Potamogeton crispus* L.), is an invasive aquatic macrophyte from Europe. It is present in almost every state in the U.S., including over 750 lakes in Minnesota. *P. crispus* has been problematic in many ways; it crowds out native aquatic plants, alters lake ecosystems, and contributes to eutrophication. Although the plant can be controlled by herbicides, it can return each year due to resistance from its turions, or reproductive buds. The turions remain viable for at least four years.

We examined factors that are related to sprouting of turions. We examined variables such as light and temperature, and predictors such as carbohydrate content, phenolics (tannins), and hormones (abscisic acid). Results indicate that the amount of free glucose and starch in the turions ranges from 21.55-34.09 mg/g glucose, and tannic acid ranged from 28.87- 51.70 mg/g. Light has been found to enhance the sprouting of turions. The information found will be used to further find ways to control *P. crispus*.

Results

Light

Turion Sprouting Results (6/15/0 through 7/9/08)



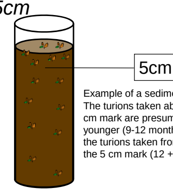
Autumn Simulation Results:

Preliminary results indicate that, when subjected to autumn lighting (10L:14D), 22% of the new turions produced sprouts during a period of 4 weeks.

Carbohydrates

Old Turions

Age: Top 5 cm vs. Bottom 5cm



Example of a sediment core. The turions taken above the 5 cm mark are presumed to be younger (9-12 months old) than the turions taken from the below the 5 cm mark (12 + months).

Sample Type	Free Glucose (mg/g) ± 1SD	Starch (mg/g)	Tannic Acid (mg/g)
Lake Sarah Above 5cm Presumed 9-12 months old No Sprouts	7.60 ± 0.30	13.95 ± 0.81	28.87 ± 3.40
Lake Sarah Below 5 cm Presumed 12+ months old No Sprouts	8.12 ± 0.28	15.97 ± 0.86	35.74 ± 3.29

Sprouting: Before vs. After

Sample Type	Free Glucose (mg/g)	Starch (mg/g)	Tannic Acid (mg/g)
Lake Sarah Above 5cm No Sprouts	7.60 ± 0.30	13.95 ± 0.81	28.87 ± 3.40
Lake Sarah Above 5 cm Sprouts*	14.54 ± 1.01	18.06 ± 2.91	34.12 ± 4.97

*Sprouts were approximately 1-3 days old

New Turions

Leaves: With vs. Without

Sample Type	Free Glucose (mg/g)	Starch (mg/g)	Tannic Acid (mg/g)
Lake Sarah New Turions With Leaves	9.94 ±0.86	24.15 ±2.45	32.92 ±0.97
Lake Sarah New Turions Without Leaves	6.77 ±1.30	21.20 ±0.60	33.93 ±2.37

Conclusions

- Light enhances sprouting of turions
- Concentration of starch and free sugars are similar in turions from the top 5 cm and those buried deeper
- Turions begin to convert starch to free sugars for energy upon sprouting
- Turions contain a relatively high amount of tannins than other plants

Future Work

Preliminary results indicate that abscisic acid is present in the new turions. Future work includes determining if abscisic acid must be present in order for the turions to remain dormant.

Turions will be exposed to cold water temperatures for various amounts of time before being placed in growth chambers to determine if exposure to “chill” affects sprouting.

References

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