

Macrophyte Flight

How Duckweeds Use Turions to Escape Abiotic Stress

What are duckweeds?

- Lemnoideae subfamily of Araceae
 - *Lemna*, *Spirodela*, *Landoltia*, *Wolffia*, *Wolffiella*
- Simple morphology
 - Stem/Leaves combined in thallus (frond)
 - Rootlets with no hairs or roots absent
- Flowering rare or never observed
 - Growth is via vegetative budding
 - Consequence is rapid growth rates

What Makes Them Weeds?

- Plants float at surface of water
 - Develop thick mats in eutrophic waters
 - Shade out submerged vegetation

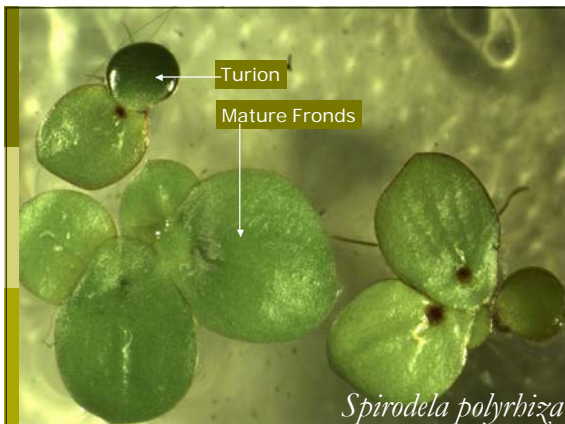


The Downside to Being on Top

- ❑ Fronds cannot survive through winter
 - Ice forms from the surface down
 - Seed production is sparse or non-existent
- ❑ Duckweeds must either escape the surface, or be confined to regions without ice formation

Turions

- ❑ Turions are modified fronds
 - Primary carbohydrate is starch (70%)
 - No air pockets (aerenchyma) to aid in buoyancy
 - Smaller than mature fronds
- ❑ Turions enable duckweeds to overwinter
 - Sink when detached from parent frond
 - Refloat in spring to begin vegetative growth



Mechanisms of Turion Production

- Primary inducers of turion production
 - Low Temperature
 - Low Phosphate Levels
 - Low Nitrate Levels
 - Abscisic Acid
 - Phytochrome (germination of turions in spring)
- Factors favoring growth increase # of turions formed

Co-action of temperature and phosphate in inducing turion formation in *S. polyrhiza*

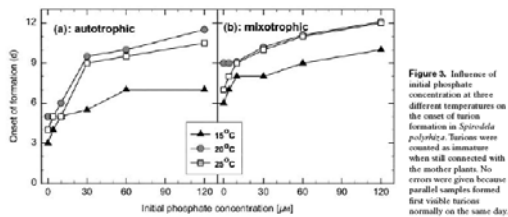
K Appenroth 2002

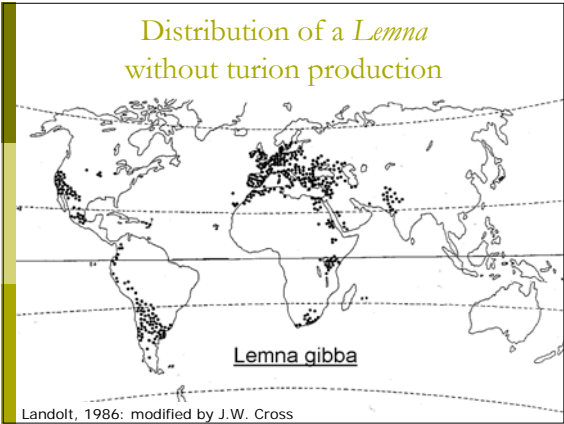
- Looked at specific turion yield
 - How many turions produced by each frond
- Looked at time of onset
 - Point in time when turions were produced
- Investigated phosphate concentration
 - 0, 4, 10, 30, 60, and 120 uM Phosphate
- Investigated water temperature
 - 15°C, 20°C, 25°C

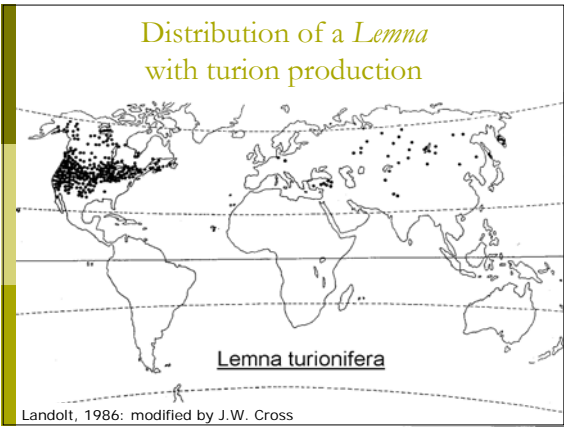
Results: Time Until Turion Production

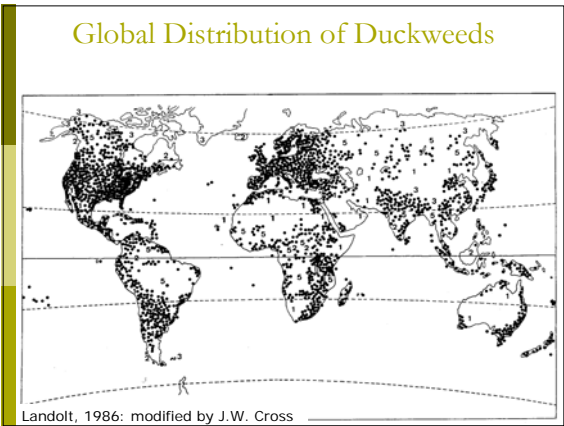
- Turions formed earlier at low phosphate and at low temperature
 - 1-4 day difference

Turion induction in *Spirodela polyrhiza* 1003









References:

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