Biology and Control of Floating Heart (*Nymphoides cristata*)

Leif Willey – University of Florida Center for Aquatic and Invasive Plants
Nymphoides - Dicotyledons

• About 50 species world wide
  – All aquatic, found on every continent except Antarctica
  – Common weeds in rice fields

• 5 species found in US (2 natives)
  – all 5 found in FL

• Nymphaeaid growth

• Multiple methods of vegetative spread
Nymphaeaid Growth Form

- Floating leaves
- Elongated stem
- Sediment surface
- Roots
N. cristata

Nymphoides aquatica
tubers

N. cristata

Created floating heart
Nymphoides cristata
Photo by Ann Murray
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N. cristata
Distribution of Exotic *Nymphoides* in the US

Jacono and Langeland
Distribution of Native Nymphoides

Nymphoides cordata

Nymphoides aquatica
Identification

- *N. peltata* (introduced)

*N. Cordata* (native)

*N. Aquatica* (native)

*N. Cristata* (introduced)
N. indica (introduced)

Feathery projections covering petal
N. cristata (introduced)

Erect Longitudinal Crest
N. cordata and N. aquatica (Natives)
Buying Invasives Online

• Out of state
  • http://www.pondplants.com
  • http://toptropicals.com/
  • https://www.pondmegastore.com
  • http://www.watergarden.org
  • http://www.grassrootsnursery.com/
  • http://www.lilypons.com/
  • http://www.pondplants2you.com
  • http://www.pondworld.com
  • http://www.blueridgefish.com
  • http://springdalewatergardens.com

• In state
  • http://www.floridaaquatic.com
  • http://www.aquariumplants.com
  • http://asr4ponds.com/
  • http://coolponds.com

Aquatic nursery Industry ~ $1billion
N. Cristata (crested floating heart)

Native to Asia
- First report 1996
- Few scientific studies

ID characteristics
- Flower
- Floating leaves
- Habitat

Invasiveness
- Spread
- Problems
Why Study Floating Heart?

• Continuing to Spread
  – Water gardens and site transfer
• Very limited information on *N. cristata*
• Difficult to manage
  – Low success rate with various herbicide approaches
  – no accepted standard for control
• Grass carp are not a viable option
  – Rapid spread in Lake Marion/Moultrie (Other SE Reservoirs where carp are stocked ?)
N cristata is a Category 1 Invasive species in FL(2009)

Category 1: invasive exotic that is displacing native species, changing community structures, or ecological functions. Present in natural areas
Invasive potential

*N. Cristata* in Lake Marion, SC
20 acres to 2000 acres in 2 yrs

- Spread
- Competitive ability
- Herbicide response
  - current techniques
Canal in SW Florida
N. Cristata Growth studies

- Soil type and soil fertility
- Light Intensity
Sediment & Fertility

• 3 soil types
  - Lake Toho (97% sand),
  - Orange Lake (77% O.M)
  - Potting soil mix

• Highly fertile sand sediment yielded greatest growth

• Non amended lake sediments = poor growth

• Growth more dependent on nutrient availability than sediment type
Light Intensity

- Daughter plants established at 5 light intensities – (1, 5, 25, 50 & 100% incident light)

- Measured parameters peaked at 25% light

- At 1% light (~20 µmoles) - daughter plants produced small viable leaves that reached the water surface
Management Research Objectives

• Determine response of *N. cristata* to herbicides
• Does method of application influence efficacy?
  – Emergent vs. submersed
• Does herbicide formulation influence efficacy?
  – Granular vs. liquid
• Determine factors that influence herbicide translocation
  – E.g. water depth, leaf surface area
Translocation ?
Herbicide Screening

• All registered aquatic herbicides evaluated
  - Comparative Trials – Focusing on short exposure times
  - Exception – ALS herbicides and Fluridone = static exposures

• Method of application
  – Emergent
  – Submersed
    * liquid vs. granular
Growth regulators

- 2,4-D and Triclopyr - dicots
- 24 and 96 hour exposures
  - Liquid and granular
- Emergent 1 to 4 qts/acre
- No reduction of biomass at 4 WAT
- Limited visual injury

[Graph showing mean dry weight at 24 hr. exposure 4WAT]
Contact Herbicides

- 24 & 96 hour exposures
- Foliar and submersed strategies tested
- Formulation had limited impact
- Greater reductions in biomass at 96 hour exposure
Contact herbicides cont.

- Diquat at 370 ppb regrew to pre treatment dry weights with 24 Hr exposure
- Hydrothol was most effective at preventing regrowth
Systemic herbicides

- Static exposures
- Foliar and submersed treatments
- Imazamox and Imazapyr applied foliar yielded fast burn down with no regrowth at 4 WAT.
- Glyphosate alone not effective
Results and Ongoing Research

• Herbicides –
  – good at removing surface leaves
  – Poor at controlling the plant

• Compare foliar and submersed strategies for the most active herbicides
  – Strategies to control daughter plants

• Competition studies with hydrilla
Hydrilla and Nymphoides –

- Growth at low light intensities
- Growth from propagules (tubers or daughter plants)

Rapid growth to water surface

Formation of large contiguous canopies

Grass Carp
- Love Hydrilla
- Hate Nymphoides
Questions?