SS-AGR-344

UF UNIVERSITY of FLORIDA
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# Aquatic Weeds: Crested Floating Heart (*Nymphoides cristata*)[1]

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## Classification

**Common name:** Crested Floating Heart

**Scientific name:** *Nymphoides cristata*

**Family name:** Menyanthaceae, Buckbean

## Identification

Crested floating heart is a rooted, floating-leaved aquatic plant. It can be identified by the slender, tapered clusters of tuberous roots on the underside of its floating leaves. The flowers are unique to the species in that they bear an erect fold of tissue that runs down the length of the upper side of the petal. There are five total *Nymphoides* species in Florida; this includes two natives, *N. cordata* (little floating heart) and *N. aquatica* (banana lily), and three exotic non-native species, *N. indica* (water snowflake), *N. peltata* (yellow floating heart), and *N. cristata* (crested floating heart). Table 1 shows a key to the species of floating heart found in Florida.

**Table 1.** A key to the floating heart species in Florida

| Characteristics | Species |
|---|---|
| #1. Flowers with yellow petals<br>#1. Flowers with white petals | *N. peltata* (Figure 1)<br>#2 |
| #2. Petals with numerous hairy projections<br>#2. Petals without hairy projections | *N. indica* (Figure 2)<br>#3 |
| #3. Petals with erect crest down the center<br>#3. Petals without erect crest | *N. cristata* (Figure 3)<br>#4 |
| #4. Leaves with rough (pebbled) underside<br>#4. Leaves with smooth underside | *N. aquatica* (Figure 4)<br>*N. cordata* (Figure 5) |

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**Figure 1.** *N. peltata*, yellow floating heart

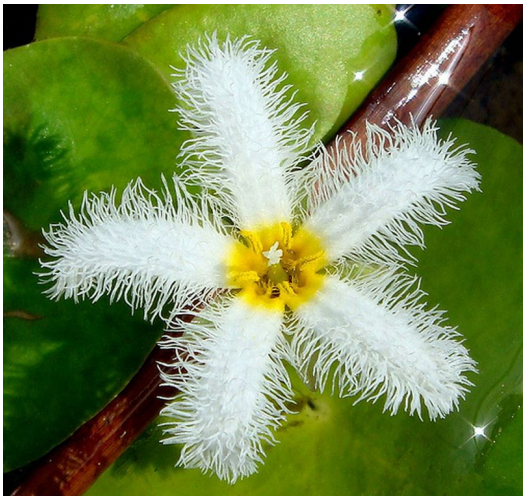

**Figure 2.** *N. indica*, water snowflake

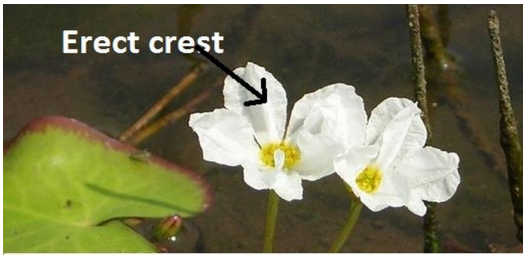


**Figure 3.** *N. cristata*, crested floating heart


**Figure 4.** *N. aquatica*, banana lily


**Figure 5.** *N. cordata*, little floating heart

## History and Distribution

Crested floating heart is a native of Asia, but was introduced to North America through the aquatic plant nursery trade and marketed as 'snowflake' (Burks 2002). In the United States, crested floating heart escaped from cultivation and became established in Florida water bodies (Burks 2002). It was first reported to be present in Horseshoe Lake in Collier County, Florida, in 1996. It has since been confirmed in numerous bodies of water throughout the state. The population of *N. cristata* in Florida became so large that movement outside the state was likely, if not inevitable. This was confirmed in 2006 when this plant was observed in Lake Marion, a 110,000-acre reservoir in South Carolina.

Crested floating heart can be found in various water bodies throughout Florida. Plants have been confirmed in Broward, Collier (in Big Cypress National Preserve), Hillsborough, Lee, Orange, Palm Beach, Sarasota, Osceola, and St. Johns Counties (Wunderland 2011) (Figure 6). Out of state, it is found growing abundantly in Lake Marion, South Carolina (Figure 7). In 2010, it was found growing in scattered locations in Lake Okeechobee (Renney, personal communication 2011).

### Habitat

Crested floating heart is typically found rooted in the submersed sediments in shallow water (less than 2 feet deep to about 10 ft deep), depending on water clarity, with its leaves floating on the surface of the water. It grows best in tropical to subtropical climate zones where it inhabits lakes, ponds, canals, and areas

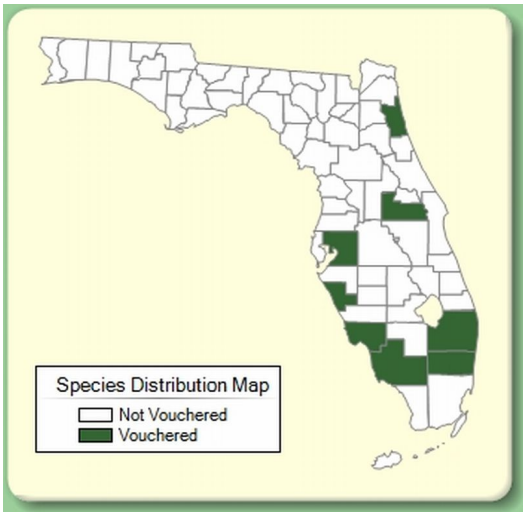


**Figure 6.** Distribution of crested floating heart in Florida (Wunderland 2011).

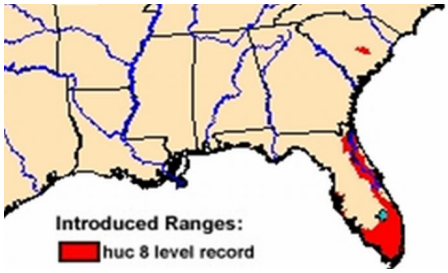


**Figure 7.** Overall distribution of drainages where crested floating heart is found (USGS).

of rivers with low current flow. It is also capable of growing and producing leaves in moist, non-submersed soils (Figure 8).


**Figure 8.** Crested floating heart growing in moist soil in a greenhouse.

## Biology

Crested floating heart is a dicotyledonous aquatic plant that exhibits a nymphaeid growth form, meaning the plant is rooted in the submerged sediment and produces floating leaves at the ends of long stems. Rooted plants produce a number of leaves, and while most of them float on the surface of the water, some leaves remain submersed. Crested floating heart is also capable of a free-floating form for a period of time with tuberous propagules attached to the underside of the leaf (Burks 2002). Sexual reproductive ability of crested floating heart in North America is suspected to be monoecious, but this is not known for sure (Burks 2002). Vegetative propagation is commonly observed in this plant, and vegetative reproduction occurs through numerous methods, including tubers, daughter plants (Figure 9), rhizomes, and fragmentation.

Invasive potential of this plant is highly evident. It is an aggressive plant that is capable of outcompeting native vegetation by forming dense floating canopies. The multiple methods of vegetative reproduction contribute to its spread and invasiveness. In Lake Marion, South Carolina, the population was recorded to cover 20 acres in 2006, but a 2011 survey concluded that it now covers over 2,000 acres. In 2009 the Florida Exotic Plant Pest Council listed crested floating heart as a "Category I" invasive species, indicating that this species has the potential to alter native plant communities by displacing native species and by changing community structures or ecological functions (FLEPPC 2009).

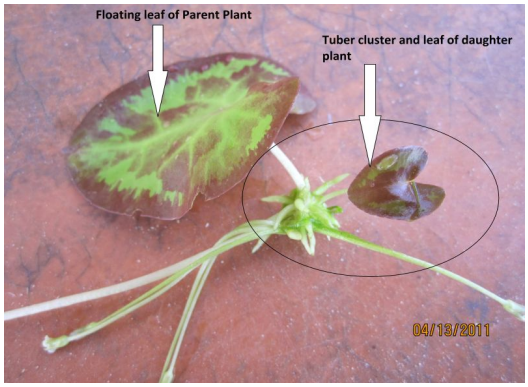


**Figure 9.** Daughter plant formation at tuber cluster below floating leaf.

## Management

Currently, no known insect herbivores specifically feed on this species. Additionally, grass carp (*Ctenophryngodon idella*), the weed-eating fish used for biological control of many aquatic weeds, have also proven to be ineffective in controlling

crested floating heart. The South Carolina Department of Natural Resources has reported winter lake level draw downs of Lake Marion, which expose the plants to drying and freezing, have failed as a means of control. Mechanical harvesting is also reported to be ineffective in the native range of the plant. Because of crested floating heart's fast, aggressive growth and vegetative spread, chemical control is likely to be the best way to control infestations and remove new colonies. Various forms and combinations of herbicides have been used but with no long-term success.

**Glyphosate and imazapyr**: In Florida, Collier County Storm Water Management has achieved up to 4 weeks of control of crested floating heart growing in shallow water by using a combination of glyphosate and imazapyr. Control with this combination was shown to be short-lived and numerous re-treatments were required (Burks 2002). This observation was confirmed in Lake Marion, South Carolina, where glyphosate/imazapyr has been applied at rates of 0.5/0.25 gallons per acre, respectively, with regrowth observed in less than 6 weeks (Davis, personal communication 2011). In other locations, it was observed that the glyphosate/imazapyr combination effectively killed the exposed foliage, but the tuber clusters floated away and re-grew (Wolfe, personal communication 2011).

**Endothall:** In greenhouse studies, 1.5-2.5 ppm endothall resulted in 98-100% control at 8 weeks after treatment when applied to the foliage. Approximately 80-90% control was achieved when endothall was applied to the water column (Puri and Haller 2010). However, the long-term impacts of these treatments were not determined considering that the principal issue with control of floating heart is completely killing the tubers. On lake-scale applications, endothall applied to crested floating heart as Aquathol K at 5 ppm and Hydrothol 191 at 0.3 ppm was found to provide no better control than the glyphosate/imazapyr combinations (Renney, personal communication 2011; Wolfe personal communication 2011). Plants treated with endothall usually recovered full growth in about 45 days (Renney, personal communication 2011). In South Carolina, Aquathol K has been used at 2-3 ppm in a submersed application, resulting in excellent control in shallow, still areas, but poor control in deep moving water. Regrowth has been sparse up to 8 weeks after treatment (Davis, electronic communication 2011).

**Other herbicides:** Crested floating heart has not been affected after treatment of other target species with fluridone, diquat, 2,4-D, or triclopyr (Renney, personal communication 2011; Wolfe, personal communication 2011).

Applications in South Carolina have also included the use of imazamox in combination with glyphosate at rates of 1.0 gallons per acre of each product. Applied foliarly, this resulted in good control in shallow waters and most deep areas with little regrowth observed after 8 weeks (Davis, electronic communication 2011). Other submersed applications were also used with granular 2,4-D at 2 ppm, triclopyr at 1 ppm, Renovate MAX G at 4.2 ppm. Applications of 2,4-D and triclopyr resulted in regrowth in 4-6 weeks, while Renovate Max G applied in August 2010 offered excellent control in 1.0 acre test plots with very little regrowth noted as of early April 2011 (Davis, electronic communication 2011).

It is difficult to develop a standard recommendation for this plant from the limited experimental trials. However, from the experimental evidence that has been collected, it is likely that applications of glyphosate/imazapyr mixtures as well as endothall would be most effective in shallow water, while glyphosate/imazamox mixtures or Renovate MAX G might be most effective in deep water.

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