



**INTEGRATED PEST MANAGEMENT
SUB-COMMITTEE
MEETING AGENDA
MONDAY, MAY 3RD, 2021 – 2:00 P.M.
COUNCIL CHAMBERS
1225 MAIN STREET, SEBASTIAN, FL**

- I. CALL TO ORDER
- II. PLEDGE OF ALLEGIANCE
- III. ROLL CALL
- IV. APPROVAL OF MINUTES –**ACTION ITEM**
March 22, 2021 Meeting
- V. ANNOUNCEMENTS
- VI. PUBLIC INPUT
- VII. NEW BUSINESS
 - Item A. Amended Meeting Schedule**–**ACTION ITEM**
 - i. Five new dates added through July 12th
 - Item B. AVC Spraying Contract Summary**
 - i. January, February, and March added to presentation from January 11th Meeting
 - Item C. New Pests at Garden Club Park**
 - i. *Lygodium microphyllum* (Old World Climbing Fern)
 - ii. *Nyphoides cristata* (Crested Floating Heart)
- VIII. OLD BUSINESS
- IX. SUB-COMMITTEE MEMBER MATTERS
- X. STAFF MATTERS
- XI. ITEMS FOR NEXT AGENDA
 - Item A. Chemical Methodology**
- XII. ADJOURNMENT

ANY PERSON WHO DECIDES TO APPEAL ANY DECISION MADE ON THE ABOVE MATTERS, WILL NEED A RECORD OF THE PROCEEDINGS AND MAY NEED TO ENSURE THAT A VERBATIM RECORD OF THE PROCEEDINGS IS MADE, WHICH RECORD INCLUDES THE TESTIMONY AND EVIDENCE UPON WHICH APPEAL IS TO BE HEARD. SAID APPEAL MUST BE FILED WITH THE CITY CLERK'S OFFICE WITHIN TEN DAYS OF THE DATE OF ACTION. (286.0105 F.S).

IN COMPLIANCE WITH THE AMERICANS WITH DISABILITIES ACT (ADA), ANYONE WHO NEEDS SPECIAL ACCOMMODATIONS FOR THIS MEETING SHOULD CONTACT THE CITY'S ADA COORDINATOR AT (407)-589-5330 AT LEAST 48 HOURS PRIOR TO THIS MEETING. TWO OR MORE ELECTED OFFICIALS MAY BE IN ATTENDANCE.



IPM SUB-COMMITTEE AGENDA TRANSMITTAL FORM

Board Meeting Date: May 3rd, 2021

Agenda Item Title: IV. APPROVAL OF MINUTES –ACTION ITEM
March 22, 2021 Meeting

Recommendation: Sub-Committee Member Approval

Background:

If Agenda Item Requires Expenditure of Funds:

Total Cost: n/a

Attachments: March 22, 2021 Meeting Minutes

**INTEGRATED PEST MANAGEMENT SUB-COMMITTEE
MINUTES OF REGULAR MEETING
COUNCIL CHAMBERS
1225 MAIN STREET, SEBASTIAN, FL
MARCH 22, 2021**

I. Call to Order -- The meeting was called to order by Mr. Benton at 2:00 p.m.

II. Pledge of Allegiance was recited by all.

III. Roll call

Present

Mr. Carrano

Mr. Griffin

Mr. Stadelman -- (Zoom) Late arrival

Ms. Callaghan -- (Zoom)

Dr. Cox

Absent

Ms. Munroe -- Excused

Also Present:

Brian Benton, Leisure Services Director

Kim Haigler, Environmental Planner

Barbara Brooke-Reese, MIS Manager

Janet Graham, Technical Writer (Zoom)

IV. Announcements -- None

V. Public Input

Jim Clifton, Sebastian. He thanked Mr. Griffin for the work that the stormwater crew has been doing in his neighborhood. He stated he has never seen the ditches as close to and/or probably at their as-built condition as they are presently. He asked Mr. Griffin to pass his sentiments on to his stormwater crew.

Bob Stephen, Sebastian. He thanked the Sub-Committee and the work they are doing on this project. He stated he has been a very active environmentalist in the City for the past several years. He reviewed that it has been stated that it is way too expensive to use methods other than spraying, and he does not think that is correct. He stated that he was recently told by another environmentalist that the City was planning to plant more grass. His understanding is that the plan is to kill the grass. He questioned what it will

cost to replace the wildlife, such as manatees, that are killed. Further, he stated veterinarians are saying that dogs are being treated for poisoning. He asked what it will cost to replace the Indian River Lagoon. He asked if the members had reviewed the report on the Lagoon by Leesa Souto, and he suggested they should listen to what she has said. He suggested that the Sub-Committee should study the report from the United Nations on its environmental study. He again recommended the Sub-Committee watch Sr. David Attenborough's documentary. He also stated that there are environmental books available from the Friends of the St. Sebastian River, and they are being offered on loan to anyone who is interested in reading them.

There being no one else in chambers or on Zoom, Mr. Benton moved to the next item on the agenda.

VI. New Business

A. Meeting Schedule Modification

- i. Moving the April 5th meeting to April 12th

Mr. Benton reviewed that after the last meeting it was discovered that there was a conflict with another meeting that was already scheduled in chambers on April 5th. Staff is requesting to move that meeting to the following Monday, April 12th, at 2:00 p.m. There being no comments or questions regarding this date change, Mr. Benton called for a motion. A motion to move the April 5th meeting to April 12th was made by Mr. Griffin, seconded by Mr. Carrano, and approved unanimously via voice vote.

Dr. Cox asked if there will be any meetings in May. Mr. Benton stated that he does not have the calendar in front of him, but there is one scheduled for May 3rd, and he does not know if there will be another one needed in May, but there probably will be. Dr. Cox stated he will be up north by that time, but he will attempt to join the meetings via Zoom.

VII. Old Business

Item A -- Section V, Ditches/Rights-of-Way/Dry Retention Areas

- i. Review and Discussion

Ms. Haigler stated that in the original discussion on this section, only ditches were discussed. It became clear that Rights-of-Way and Dry Retention Areas should be

discussed as well. She described that the ditches connect all the City's waterways and canals. The rights-of-way are the access points along drainage easements or drainage easement buffer zones, so the ground cover needs to be maintained in those areas. All these areas, the ditches, rights-of-way, and dry retention areas, are areas that are just mowed. Spraying is almost never done in those areas. She discussed why these areas need to be maintained and how they are maintained by the contractor through mowing.

ii. City Mowing Contract

Ms. Haigler stated that these areas are maintained regularly through a mowing contract, a separate contractor who goes through from one end of the City to the other on a constant cycle of mowing in the ditches, the rights-of-way, and the dry retention areas. She then asked Mr. Griffin to speak more on this subject.

Mr. Griffin explained that the largest expense in the stormwater program is to maintain by mowing the extensive network of ditches and swales that constitute the City's stormwater system, and it is done by 100% mowing and subsequent removal of material. The contractor maintains an annual contract that costs the City in excess of \$300,000.00 a year. The City crews remove the accumulated material and muck at least once a year from all the swales, ditches, and other portions of the stormwater system. In addition to this, the City crews also mow the properties which are vacant and not being maintained by the property owners such that the stormwater system is functional for all the other property owners who have built on their lots and maintained their systems so as to keep the entire system functional.

Mr. Benton called for comments/questions from Sub-Committee members under Sections i and ii under Item A.

Dr. Cox had some suggestions regarding the wording in these sections as follows: In the first paragraph under Ditches, Rights-of-Way, Dry Retention Areas, he suggested the word **flow** instead of **connectivity** would be more appropriate. Ms. Haigler agreed. Under Non-Chemical Methods where it says, "**These assets are virtually never treated with herbicides.**" his question is: When would they be treated, when would they be sprayed with herbicides? Mr. Benton stated that it is probably 99+% of the time they would not be treated with herbicides, but that cannot be completely eliminated. Dr. Cox asked where it mentions **the duration of the project**, he asked what projects are being talked about. Ms. Haigler stated that it refers to being at sites of development when that project is inspected. That is part of the Stormwater Ordinance that she emailed to everyone, and it will be addressed in the appendix. Dr. Cox referred to where it says, "**Mow at correct height. Mowing to low...**" should be **Mowing too low...**" and "**Tools**

should be sanitize...” should be **“Tools should be sanitized...”** He also asked where it says that the contractors have to pick up and carry away what they have cut. Mr. Griffin stated that is not practical for any mowing operation. What occurs is that the City crews go back in--it is one of the largest jobs done by the City each year—and remove excess vegetation, muck, and debris at least once a year from all City drainageways. That operation has been underway very dramatically for the last eight months.

Mr. Carrano referred to page 14 where the word **“dredging”** is used, dredging connotes that digging in a waterway is being done, and in this case we are not. He suggested the wording should be **“excavation of sediments”** and not **“dredging.”**

Mr. Benton referred to the sentence that says, **“Always mow with sharp blades,”** it should read, **“Cleaning of these tools”** instead of **“Cleaning the these tools,”** and there should be a period at the end.

Mr. Benton then opened the meeting for public input.

Bob Stephen, Sebastian. He referred to the huge amount the City spends for mowing. He asked if we need all the grass, and can't we go back to natural Florida. Mr. Griffin stated the City is not planting anything; only what already exists is being mowed. Ms. Haigler added that it is just the ground cover that was already there. Nothing has been added.

Seeing no one else in Chambers who wished to speak and hearing no one on Zoom, Mr. Benton moved to the next item on the agenda.

B. Section VI. Further Non-Chemical Recommendations

- i. Review and Discussion
- ii. Stormwater Fee Credit Program

Ms. Haigler stated this is regarding other things that have been brought up but are not planned to be implemented immediately, but we want to look at through our annual review. Among these subjects is the seawall construction. There was also a skimmer device that Mr. Stadelman had mentioned that is movable between the ponds and gets the small floating vegetation. At this point, those are not huge problems in the City's system, but they may become such. So this will be revisited and reevaluated in the future. Also discussed was the expanded dredging of some of the open water areas where it might be feasible. There is also the stormwater fee program. She handed each Sub-

Committee member a sample of the postcard that was sent out last October or November to some of the large commercial property owners regarding getting their refund and/or their stormwater fee credits. She briefly explained this program to see how it fits with the IPM program.

Dr. Cox referred to where the language, “**Environmental enhancements**” is used, there is a sentence that follows that does not have a word at the end of it. Ms. Haigler stated that “**for the**” gets taken out. He asked if there is any such thing as a self-maintaining littoral shelf with native aquatic vegetation. If there is, how much work is necessary to maintain it? Mr. Griffin stated that it can be done with proper planning and proper timing. He further stated it was done very successfully in Hardee Park. He stated that his department plans to repeat many times over the successes that were achieved at Hardee Park by planning high-quality native vegetation. Mr. Benton agreed that it should be tried in order to see what can be done in order to see if there are things that can be changed along the way to try and make it work rather than to not do it at all. Mr. Griffin said it is part of the key ingredients in the City’s large \$24 million grant application to the Florida Department of Economic Opportunity that is under consideration presently.

Mr. Carrano referred to the section which states the seawalls hold back nutrient-laden sediments. He suggests that the seawalls do not hold back nutrients at all; they hold back sediments. Whether those sediments are nutrient laden or not is not consequential because the water will pass the sediments right under the seawalls.

Mr. Carrano asked Ms. Haigler if in the City Code there is a definition of a buffer area. Ms. Haigler opined that for most of the stormwater bodies of water the buffer area is 10 feet and in natural areas it is 25 feet. Mr. Carrano suggested language describing the littoral area and a 25-foot buffer area.

Mr. Benton asked Ms. Haigler if aeration was included in the non-chemical recommendations. Ms. Haigler said it was.

Mr. Benton then opened the meeting for public input on Item B. Section VI. Further Non-Chemical Recommendations.

Bob Stephen, Sebastian. He asked if the non-chemical recommendations are listed in the whole plan, because he did not hear a lot of non-chemical recommendations. He also asked if anyone was sent to Brevard County to see what they are doing, as they have two mechanical harvesters, and there was also discussion from someone about using steam in other communities. Mr. Griffin stated that as part of the grant application last year there was a similar application for a Weed-o and a barge. Unfortunately, Sebastian did not

compete successfully. He does not know why. Mr. Stephen spoke regarding the high-quality plants in Hardee Park, and asked if they crowd out the invasives. Mr. Griffin said that they have been successfully established. Mr. Stephen opined that the first two months that the new company who was hired came in, they killed all those plants with poison. Mr. Griffin stated he does not believe that to be the case.

Ms. Haigler stated she could comment on the mechanical harvester used in Brevard County. It requires a 10-foot depth throughout. Sebastian does not have the depth of its waterways to accommodate the equipment that Brevard is using. Anything smaller seems to be virtually inefficient. She also pointed out that 50% of Sebastian's canal system are not accessible because of the pipes, dams, and weirs contained in the system.

Seeing no one else in Chambers and hearing from no one on Zoom, Mr. Benton moved to the next item on the agenda.

VIII. Sub-Committee Member Matters

Mr. Stadelman stated that the book Mr. Stephen mentioned, "Silent Spring," is a very interesting book. He further stated that, even in that book, the author was not 100% against spraying. Regarding the documentary by David Attenborough, it went from catastrophe to catastrophe, and basically it was a roadmap of total earth catastrophe. It included some opinion, some fact, and some conjecture. But the different things that these people mentioned are happening. He suggested that Sebastian City Council is being as proactive as a city council can be. He pointed out that a lot of these products that are being used are being used by individuals who buy it off the shelves and apply it on their lawns, sometimes not according to directions.

Dr. Cox asked if the City has received the bills from Aquatic Vegetation Control as to what product or products have been used. Mr. Griffin stated that the herbicide use is variable depending on the circumstance, but his department does review those reports and their invoices.

IX. Staff Matters

Ms. Haigler thanked Mr. Stadelman for mentioning the book and the documentary, and she agreed that "Silent Spring" is very inspirational. It is what started the modern environmental movement and started the regulation of herbicides. After studies on DDT, fat-soluble pesticides like that are no longer permitted. David Attenborough's documentary discusses how things have changed over his lifetime. Ultimately, his whole

discussion leads back to preservation of biodiversity, which is what this Sub-Committee is trying to achieve.

Mr. Benton addressed the concerns from the public as to whether this Sub-Committee and staff are listening to what is being said during public input. He assured the public that those concerns are being heard and addressed. He pointed out Brevard County does have a half-cent sales tax that was put in place by the voters. It is a "Save Our Indian River Lagoon" sales tax that was voted on by the residents. It was put in place for 10 years that would generate somewhere in the range of \$489 million as he recalls. Each one of the municipalities in Brevard County can go to the County and request grant funds. He stated that Sebastian staff have looked into the mechanical harvesters that Brevard County has, and Ms. Haigler has had quite a few conversations with them. He also asked that residents look at the spray contracts that are out there as well in Brevard County. He opined that they have done a great job with that half-cent sales tax. He agrees that it is doing a lot for the environment, but they are also spraying. He will continue to point out that the amount of chemicals that the City of Sebastian uses on an annual basis is a "drop in the bucket" if you compare the figures from elsewhere. He commended the Sebastian Stormwater Department for the good job they are doing clearing the ditches and swales and rights-of-way, and he asked Mr. Griffin to make sure the crews know that they are doing a great job. Mr. Griffin stated he would.

X. Items for Next Agenda

- A. **Vote for Approval on Sections II-VI regarding non-chemical controls**
- B. **Herbicide Methodology**

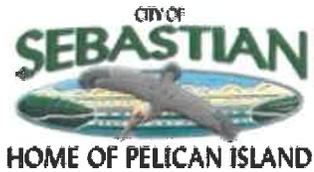
XI. Adjournment

There being no further business, Mr. Benton called for a motion to adjourn. A motion to adjourn the meeting was made by Mr. Carrano, seconded by Ms. Haigler, and approved unanimously via voice vote. The meeting was adjourned at 2:52 p.m.

By: _____

Date: _____

jg



IPM SUB-COMMITTEE AGENDA TRANSMITTAL FORM

Board Meeting Date: May 3rd, 2021

Agenda Item Title: VII. NEW BUSINESS
Item A. Amended Meeting Schedule—**ACTION ITEM**
i. Five new dates added through July 12th

Recommendation: Sub-Committee Member Approval

Background:

If Agenda Item Requires Expenditure of Funds:

Total Cost: n/a

Attachments: Proposed amended sub-committee meeting dates

Proposed Amended Meeting Schedule

Monday, May 3rd @ 2PM in Council Chambers

NRB Meeting: Tuesday, May 4th @ 6PM

Monday, May 10th @ 2PM in Council Chambers

Council Meeting: Wednesday, May 12th @ 6PM

Monday, May 24th @ 2PM in Council Chambers (*Victoria Day*)

Council Meeting: Wednesday, May 26th @ 6PM

Memorial Day: Monday, May 31st, City Hall Closed

NRB Meeting: Tuesday, June 1st @ 6PM in Council Chambers

Council Meeting: Wednesday, June 9th @ 6PM

Monday, June 14th @ 2PM in Council Chambers (*Flag Day*)

Council Meeting: Wednesday, June 23rd @ 6PM

Monday, June 28th @ 2PM in Council Chambers

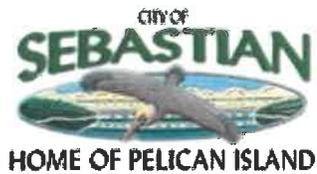
Fourth of July Event: Saturday, July 3rd, Riverview Park

Fourth of July Observance: Monday, July 5th, City Hall Closed

NRB Meeting: July 6th @ 6PM

Monday, July 19th @ 2PM in Council Chambers

Council Meeting: Wednesday, July 14th @ 6PM



IPM SUB-COMMITTEE AGENDA TRANSMITTAL FORM

Board Meeting Date: May 3rd, 2021

Agenda Item Title: VII. NEW BUSINESS
Item C. New Pests at Garden Club Park
i. *Lygodium microphyllum* (Old World Climbing Fern)
ii. *Nymphoides cristata* (Crested Floating Heart)

Recommendation: Sub-Committee Member Discussion

Background:

If Agenda Item Requires Expenditure of Funds:

Total Cost: n/a

Attachments: Info sheets on the two new invasive aquatic plants requiring treatment

Weed alert

Old World climbing fern

(*Lygodium microphyllum*)

Old World climbing fern

Old World climbing fern is an aggressive nonnative invasive fern of moist habitats in South Florida. This rapidly spreading fern invades new areas without the need of habitat disturbance and often completely dominates native vegetation by forming a dense canopy. The fern, first found to be established in 1965 in Martin County, now infests more than 200,000 acres in South Florida.

Although primarily a weed of public conservation areas, Old World climbing fern infests residential landscapes, horticultural nurseries, rangelands and other managed lands near infested natural vegetation. The fern's ability to grow up and over trees and



Lygodium acting as a fire ladder into the tree canopy

shrubs and to form dense horizontal canopies allows it to cover whole communities of plants reducing native plant diversity. Old World climbing fern can grow in bald cypress stands, pine flatwoods, wet prairies, saw grass marshes, mangrove communities and Everglades tree islands. Some Everglades tree islands are so completely blanketed by the fern that it is not possible to see trees and other vegetation beneath the fern canopy. The fern

poses management problems for both wildfires and prescribed burns because it can serve as a fire ladder that carries fire into the tree canopy that kills native trees. Also, portions of burning fern can frequently break free and spread fire to surrounding areas.

Scientists' estimate that, left unchecked, Old World climbing fern could infest more than 2 million acres in South Florida by 2014.



Close-up of the Lygodium microphyllum's convoluted leaflets

Why the Old World climbing fern must be managed:

- Highly invasive in natural areas.
- Severe threat to Everglades tree island communities
- A canopy producer that smothers native trees and shrubs.
- Can serve as a fire ladder that carries fire into native tree canopies that normally wouldn't burn.
- The fern is rapidly spreading in South Florida's public conservation lands.



A Lygodium canopy completely dominating native vegetation.



Florida Fish and Wildlife
Conservation Commission
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*Synonymy: Lygodium scandens,
Ugena microphylla*

Old World climbing fern (*Lygodium microphyllum*)

The correct name of Old World climbing fern is *L. microphyllum*, but the species is occasionally referred to as *Lygodium scandens*. As many as 40 species have been placed in the genus *Lygodium*, but a recent revision has reduced this number to 26. *Lygodium japonicum*, another invasive species in the southeastern United States, has leaflets that are more dissected and lobed than those of *Lygodium microphyllum*.



Leaves: Twining fronds of indeterminate growth to 30 m (90 ft.) long. Leafy branches off main rachis (constituting the pinnae) once compound, oblong in overall outline, 5-12 cm (2-5 in.) long. Leaflets (pinnules) usually unlobed, stalked, articulate (leaving wiry stalks when detached); leaf-blade tissue usually glabrous below; fertile leaflets of similar size, fringed with tiny lobes of enrolled leaf tissue covering the sporangia along the leaf margin.



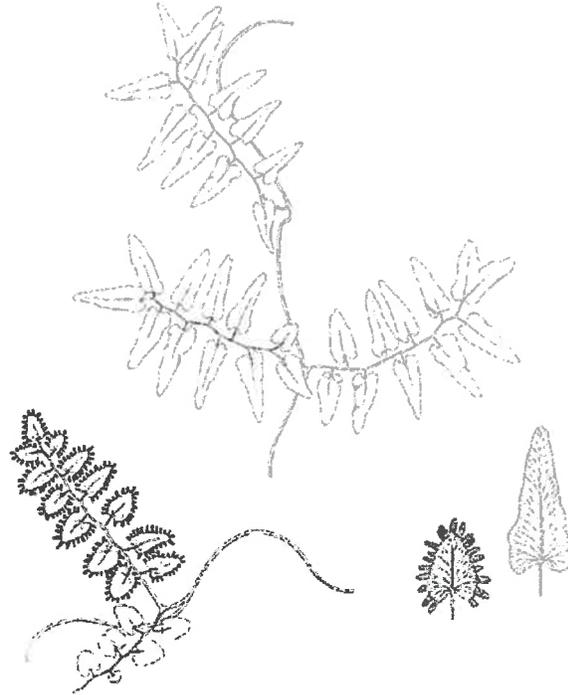
Stems: Fern with dark brown, wiry rhizomes forming layered mats or canopies over existing vegetation.



Flowers: None. Ferns are a spore-releasing class of vascular plants.



Spores: Many thousands of tiny spores released per plant and carried by wind, dust, animals, clothes, and equipment.



Photos and illustration courtesy of Center for Aquatic and Invasive Plants, University of Florida

Look for first:

- tangle of wiry, twining fronds
- fern-type leaflets
- sporangia under curled leaflet margins

Distribution

Native to Africa to Southeast Asia, South Pacific islands, and Australia. In Florida, most common in South Florida but spreading into Central Florida.

Reference: R.W. Pemberton, J.A. Goolsby, and T. Wright. 2002. Old World climbing fern. In: Van Driesche, R., et al., 2002, *Biological Control of Invasive Plants in the Eastern United States*, USDA Forest Service Publication FHTET-2002-04, 413 p.



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Florida Fish and Wildlife
Conservation Commission

Division of Habitat and Species Conservation
Invasive Plant Management Section
620 South Meridian St.
Tallahassee, FL 32399-1600
850-487-3796

Aquatic Weeds: Crested Floating Heart (*Nymphoides cristata*)¹

Leif N. Willey and Kenneth A. Langeland²

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



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

1. This document is SS-AGR-344, one of a series of the Agronomy Department, UF/IFAS Extension. Original publication date April 2011. Reviewed December 2017. Visit the EDIS website at <http://edis.ifas.ufl.edu>.
2. Leif N. Willey, graduate student; and Kenneth A. Langeland, professor; Agronomy Department, Center for Aquatic and Invasive Plants, UF/IFAS Extension, Gainesville, FL 32611.

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U.S. Department of Agriculture, UF/IFAS Extension Service, University of Florida, IFAS, Florida A & M University Cooperative Extension Program, and Boards of County Commissioners Cooperating. Nick T. Place, dean for UF/IFAS Extension.



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).

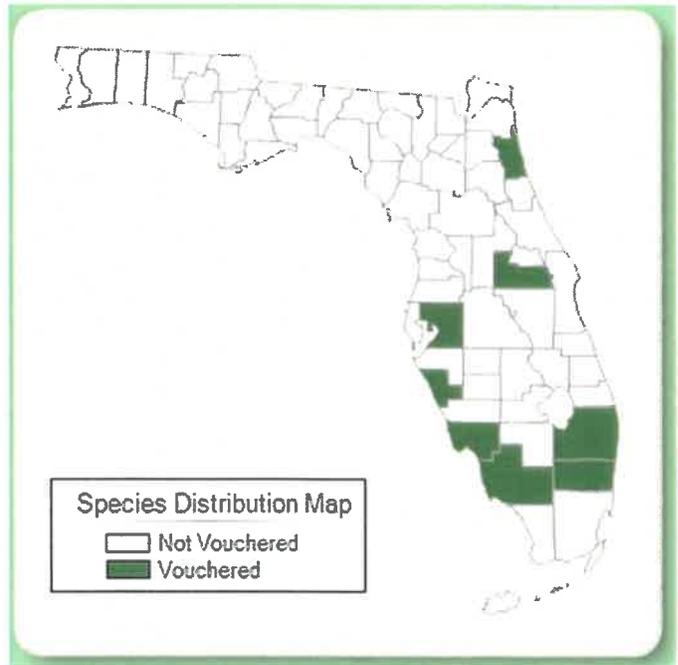


Figure 6. Distribution of crested floating heart in Florida (Wunderland 2011).

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

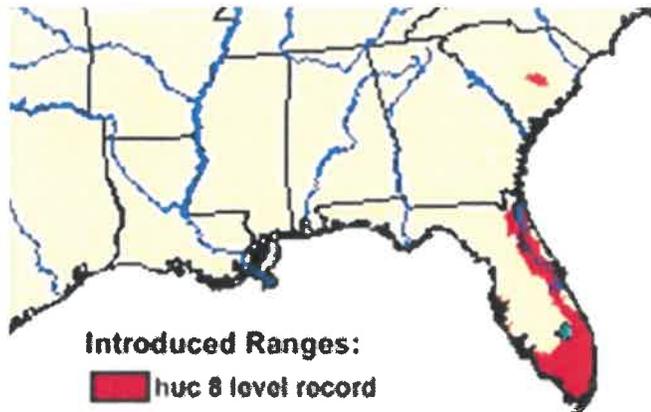


Figure 7. Overall distribution of drainages where crested floating heart is found (USGS).



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.

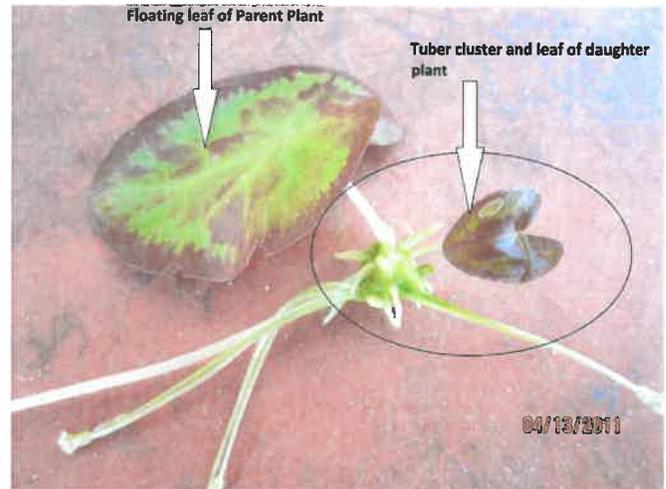


Figure 9. Daughter plant formation at tuber cluster below floating leaf.

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).

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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