

You Ain't From Around Here! Exotic Invasive of the Quarter: Giant Salvinia (*Salvinia molesta*)

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This quarter I will return to writing about what I promised to write about in the Winter edition of the VFLU – invasive species that aren't established in Virginia....but are lurking outside our borders. (Last quarter I strayed because someone offered to write an article for me about mile a minute vine and I am not one to turn down a free, well-written article.)

Let's take a look at a plant called giant salvinia. Pseudonyms include kariba weed, salvinia, water fern, and aquarium watermoss. The scientific name, *molesta*, comes from the Latin, *molestus*, meaning troublesome, irksome, grievous, annoying or tiresome. Seems appropriate based on what I've learned about this species.

Giant salvinia has several characteristics that make it intriguing. First, this recent invasive comes to us not from Asia, like so many do, but from South America. It is native to southeastern Brazil and northern Argentina. It has invaded Australia and many tropical and subtropical counties of Asia, Africa and the Pacific and is considered one of the world's worst aquatic weeds.

The first observation in the US was in South Carolina in 1995. This infestation was successfully eradicated (giving us hope!). However, since 1995, giant salvinia has become established in 24 watersheds across the southeast (none documented in Virginia yet). The USDA recognized what a potential problem this plant could be and listed it as a noxious weed in 1983, way before its arrival in US waterways (and when I had more important things on my mind – like tall bangs, Duran Duran, and Miami Vice).

Second, it is an aquatic invasive fern and I believe I have only written about 2 aquatic invasives before (see hydrilla, VFLU Spring 2008 and alligatorweed, VFLU Winter 2009). Giant salvinia is free floating. Although it can invade most aquatic systems, it thrives in slow-moving, nutrient-rich, warm, freshwater. Like other aquatic invasives, pieces of giant salvinia can be transported and spread to new areas via boats, by a piece breaking off and floating downstream, or through trading among aquatic plant enthusiasts.

Unfortunately, the leaves of this fern form long chains that develop into mats on the surface of the water. It grows very quickly - mat size can double in 7 to 10 days. In some overseas locales, mats are more than 2 feet thick. The mats prevent oxygen and light from penetrating the water. This results in the death of algae and macrophytes, the bases of the food chain. This reduction in food availability can negatively impact creatures higher up in the food chain. Additionally, giant salvinia clogs irrigation and drinking water lines, and damages hydroelectric plants. As you might imagine, giant salvinia-choked waterways are not enjoyable places to swim, fish, or boat. These mats can spread over 40 square miles of water in one year. Oh, and they are prime habitat for encephalitis-carrying mosquito species, two of which are found in the US.

Third, and most intriguing, is the frond flotation system this plant has developed. The surface of the fronds has rows of cylindrical hairs joined at the tips to form a cage or groovy eggbeater shape. These structures repel water allowing the leaves to float.



How to identify giant salvinia

Form: Each plant is a colony of ramets (an independent member of a clone – occurs when plants reproduce vegetatively, not sexually). Each ramet consists of an internode, a node, a pair of floating leaves, a submerged root (actually a modified leaf that functions as a root) and associated buds. Plants have three growth forms (see photos below). The plants move through the different growth forms as an invasion progresses and crowding becomes more of an issue.

The eggbeater-like structures provide buoyancy for the leaves. Photo by: Barry Rice, sarracenia.com.

Fronds/Leaves: Green to gold to brown; oblong; floating; 0.5 – 1.5 inches long; tops covered in rows of cylindrical hairs topped with 4 branches which are joined at the tips to

form an eggbeater shape; immature leaves lie flat on the water's surface; mature leaves are forced upright, out of the water.

Roots: Free-floating; submerged; conceal stalks with egg-shaped (infertile) spore cases attached.



These images show the three growth forms of giant salvinia. As an invasion progresses, the plants become more crowded. As the plants become more crowded, they move from the primary growth form made up of individual free-floating plants (a), through the secondary form (b) and ultimately, in a well-developed invasion, to the tertiary form (c). Photos by: (a & c) Mic Julien, Commonwealth Scientific and Industrial Research Organization; (b) USDA APHIS PPQ Archive, USDA APHIS PPQ.

Controlling giant salvinia

For most invasive species, controlling means just that – keeping them in check, not necessarily complete eradication. In the case of giant salvinia, complete eradication is recommended. Otherwise, the rapid growth rate results in a resurgence of the species almost immediately. Fortunately, history demonstrates that eradicating giant salvinia is possible.

According to Virginia Cooperative Extension's Pest Management Guide for Horticultural and Forest Crops (<https://pubs.ext.vt.edu/456/456-016/456-016.html>) the herbicide that most effectively kills giant salvinia is diquat (brand name, Diquat). Other herbicides which have also been effective include glyphosate (Roundup), flumioxazin (Clipper), and imazapyr (Arsenal).

Follow the labels for timing and concentration.

Additionally, there is a biological control for this plant. It's a small (2 mm long) dark-colored weevil, called *Cyrtobagous salviniae*, or, appropriately, the salvinia weevil. These weevils kill salvinia in two ways. First, the adults eat the small developing buds and new leaves. Second, the females lay their eggs in pits in the leaves, rhizomes, petioles and roots. The newly hatched larvae damage the plants by tunneling.

The salvinia weevil successfully controls giant salvinia in 12 countries, mostly in tropical and subtropical climates, although a few are in temperate climates. Research shows that releasing more cold-tolerant strains of the weevil could be more effective in temperate climates - which may be especially important for Virginia at the northern edge of the infestation in the US. If the infestation is large, herbicides may be needed as well.

Keep an eye out for this plant over the summer while you are out boating, swimming and fishing in Virginia. If you see it, be sure to report it using the Mid-Atlantic Early Detection Network smart phone App, available free at <http://apps.bugwood.org/apps.html>.

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The salvinia weevil is keeping giant salvinia under control in over 12 countries across the world. Trials in Louisiana have shown it to be effective in the US as well. Photo by: Richard Chan, Commonwealth Scientific and Industrial Research Organization.