Giant Salvinia, Kariba-weed (*Salvinia molesta* Marshall)

John D. Madsen, Ph.D., Extension/Research Professor, Mississippi State University
Ryan Wersal, Ph.D., Research Associate, Mississippi State University

Fig. 1. The mat forming stage of giant salvinia displaying the erect pairs of curled emergent leaves. Photo by Ryan Wersal.

Fig. 2. An individual giant salvinia plant, displaying fronds, horizontal stem and submersed stalks. Photo by Ryan Wersal.

Fig. 3. A magnified view of the cage-like or egg beater-shaped hairs on the surfaces of giant salvinia fronds. Photo by Julie Graham.

Introduction

Problems caused

Giant salvinia (*Salvinia molesta* Mitchell) is an aquatic fern native to southern Brazil. Giant salvinia is free floating and can form thick mats of up to 3 feet thick when plant densities are high. The dense mats fill in water-bodies resulting in decreases in density and diversity of native aquatic plants and animals. Similarly, giant salvinia mats can affect crop production, access to waterways for humans and livestock. The ecological consequences of giant salvinia introduction have prompted the United States Department of Agriculture and the Mississippi Department of Agriculture and Commerce to list this species on both the federal and state Noxious Species List. Likewise, giant salvinia has been named the world's second worst weed.

Regulations

Giant salvinia is listed as a federal noxious weed, and listed as a state noxious weed in Mississippi, North Carolina, and Florida. It is widely regarded as a serious invasive weed problem.

Description

Vegetative growth

Giant salvinia is a rootless, free floating fern that can be identified by its broadly rounded green fronds. Pairs of these emergent fronds are produced at each node of a horizontal stem that floats just beneath the water surface. The upper surfaces of the emergent fronds display a prominent midrib that is covered with stiff white leaf hairs that aid in leaf buoyancy. The leaf hairs of giant salvinia differentiate this species of *Salvinia* from others such as common salvinia (*Salvinia minima*) and eared watermoss (*Salvinia auriculata*) by forming cage-like or egg beater shaped hairs. Giant salvinia also produces a hairless, brown submersed leaf that is often mistaken for roots. Similarly, long stalks extend beneath the water surface where sessile sporocarps are produced. Giant salvinia sporocarps are uniquely egg-shaped and occur in straight chains among the submersed leaves. Although mature plants can produce a great number of sporocarps the sporangial sacs are most often void of spores. Giant salvinia can produce reproductive structures; however the primary means of growth is vegetative.

Flowering/fruiting

Giant salvinia is a fern and produces neither flowers nor fruit. Giant salvinia forms sporocarps that are sterile, not producing any viable spores.

Dispersal mechanisms

Dispersal is entirely by the movement or drift of floating fronds. New fronds are formed in a chain along a floating horizontal stem or rhizome. These may break off to form new colonies.

Spread by

Giant salvinia has been widely used as an ornamental plant in water gardens; its spread in the U.S. has been largely through the nursery trade.

Habitat

Giant salvinia can inhabit calm waters of lakes, ponds, wetlands, and rivers. Plants have been located in ditches, rice fields, and slow moving rivers and streams. The most common habitats include disturbed habitats such as flood canals, rice paddies, artificial lakes, and hydroelectric facilities. Giant salvinia is best adapted to thrive in warm-temperate to tropical areas. Giant salvinia cannot tolerate saline environments and thus will not colonize brackish or marine environments. Likewise, this species cannot tolerate dry environments and individual plants may be killed by desiccation.

Distribution

Giant salvinia was likely introduced in the United States via the nursery trade as an ornamental species in the late 1970's or early 1980's. Records from Florida indicate that giant salvinia was in cultivation in nurseries as early as 1983. The first recorded natural population of giant salvinia was discovered in 1995 in South Carolina. Since then this species has spread through the southern United States infesting waters in Texas, Louisiana, Georgia, Florida, Alabama, California, Hawaii, Arizona, North Carolina, and Virginia. In the MidSouth, giant salvinia has been reported in AL, LA, and MS.

Control Methods

Biological

The salvinia weevil (*Cyrtobagus salviniae*) is the most notable and only organism that has shown repeated success in giant salvinia biological control. Both feeding and larval damage can reduce giant salvinia infestations when conditions are optimal for weevil growth. Optimal conditions include water temperatures between 61 and 86°F. Water temperatures outside this range results in decreased weevil performance. Similarly, feeding and larval damage depend on levels of nitrogen in plant tissues in that low levels of plant nitrogen result in low densities of the salvinia weevil.

Chemical

Herbicides are the most widely used and effective method for controlling infestations of giant salvinia. Diquat, glyphosate, and tank mixes of diquat and glyphosate have been the most widely used herbicides for controlling giant salvinia. Repeated treatments will be required. Other herbicides that have shown promise include glyphosate, imazapyr + glyphosate, and combinations of rates and formulations of each. Use a nonionic surfactant with these aquatic herbicides, and always read the label before using. Use only approved herbicides labeled for aquatic use.

Mechanical

Manual (hand pulling) and mechanical (wire nets and floating booms) control of giant salvinia is only practical during the early stages of growth. After giant salvinia is established in a given area, increased biomass and rapid growth makes harvesting and hand pulling unfeasible. Manual and mechanical control measures are very expensive and need frequent deployment for acceptable results.

Physical

Summer drawdown is the only physical control technique that has been effective in controlling giant salvinia.

Table 1. Recommended herbicides and rates for giant salvinia.

Herbicide	Trade name	Formulation application rate	Active ingredient rate	Nonionic Surfactant Added
Diquat	Reward	0.5 – 0.75 gal/acre	1 - 1.5 lbs ai/acre	0.25 – 1.0% v/v
Glyphosate	Rodeo	1 – 2 gal/acre	4 - 8 lbs ae/acre	0.25 – 1.0% v/v
Penoxsulam	Galleon SC	0.21 – 0.42 quart/acre	0.11 – 0.22 lbs ai/acre	0.25 – 1.0% v/v

References

Jacono, C.C. 2003. *Salvinia molesta* D.S. Mitchell. United States Geological Survey. Giant salvinia web page http://salvinia.er.usgs.gov/.

Jacono, C.C. and M.M. Richerson. 2004. The distribution and spread of *Salvinia molesta* (giant salvinia). United States Geological Survey giant salvinia web page http://salvinia.er.usgs.gov/.

Oliver, J.D. 1993. A review of the biology of giant slavinia (*Salvinia molesta* Mitchell). Journal of Aquatic Plant Management 31:227-231.

Thomas, P.A. and P.M. Room. 1986. Taxonomy and control of *Salvinia molesta*. Nature 320:581-584.

John D. Madsen, Ph.D.
Mississippi State University, Geosystems Research Institute
Box 9652, Mississippi State, MS 39762-9652
Ph. (662)325-2428, jmadsen@gri.msstate.edu
www.gri.msstate.edu