Waterhyacinth: Florida's Worst Floating Weed[1]

Lyn A. Gettys[2]

Introduction

Waterhyacinth is a free-floating aquatic plant that grows throughout the year in southern Florida but undergoes winter dieback in northern parts of the state. The species can survive moderate freezes but requires temperatures above 50°F to produce new growth. The transportation, importation, collection, possession, cultivation, or sale of waterhyacinth (a Noxious Weed) is illegal in Florida (FDACS DPI 2020), but the species is still occasionally available for purchase from some farmers' markets, yard sales, aquarium supply stores, aquatic plant nurseries, and Internet sources in other states.

Waterhyacinth is native to the Amazon River in Brazil and has invaded ecosystems throughout the world. The first documented broad introduction of waterhyacinth to the United States occurred at the Southern States Cotton Expo in New Orleans in 1884, although it is probable that the species was cultivated as a water-garden plant for many years prior to that. Visitors to the Expo were given waterhyacinth plants as souvenirs, and many of these plants found their way into the waters of Louisiana, Texas, and Florida (Klorer 1909). Anecdotal reports state that "Mrs. Fuller," an Edgewater, Florida, resident and visitor to the Expo, was entranced by the beautiful, showy flowers of this Amazonian native (Figure 1) and brought plants back to her water garden near the St. Johns River. The plants grew abundantly, and the backyard water gardener decided in 1890 to share her "bounty of beauties" with others by tossing her extra plants into the St. Johns River near Palatka.

Figure 1. Inflorescence of waterhyacinth.
Credits: Lyn Gettys, UF/IFAS

Settlers situated along the St. Johns wanted to beautify the river along their settlements as well and facilitated the spread of the species by moving plants throughout the system (Webber 1897). Within a decade, the St. Johns was so clogged with waterhyacinths that navigation had become impossible (Penfound and Earle 1948). The species rapidly expanded throughout Florida and by the 1950s had infested 126,000 acres of surface water in the state. In addition to intentional introductions like this and escape from

1. This document is SS-AGR-380, one of a series of the Agronomy Department, UF/IFAS Extension. Original publication date July 2014. Revised November 2020. Visit the EDIS website at https://edis.ifas.ufl.edu for the currently supported version of this publication.

2. Lyn A. Gettys, associate professor, Agronomy Department, Aquatic Plant Science Lab; UF/IFAS Fort Lauderdale Research and Education Center, Davie, FL 33314.

cultivation, waterhyacinth can be spread in other ways. For example, small plants easily become caught in boat trailers or live wells, which can result in the introduction of the species to uninfested waters.

Classification

Common Name: Waterhyacinth

Scientific Name: *Eichhornia* (*Pontederia*) *crassipes* (Mart.) Solms

Family: Pontederiaceae (pickerelweed family)

Description and Habitat

The leaves of waterhyacinth are thick, glossy, waterproof, and rounded; petioles (leaf stalks) are spongy and inflated when plants have sufficient space to spread out (Figure 2), and thinner and more rigid under crowded conditions. The leaves are attached at the base of the plant to form a rosette. The long, feathery roots of waterhyacinth are dark purple to black and hang beneath the rosette of leaves (Figure 2). Waterhyacinth produces a spike inflorescence that can be up to 20" tall with 15 or more large, showy individual flowers that are up to 3" tall. Flowers have six lavender-blue to purple petals, and the uppermost petal is marked with a yellow "eye-spot." Although individual flowers only last one or two days, the spike may be showy for as long as a week because a few flowers are open each day (Flora of North America 2020).

Figure 2. Spongy petioles (left) and dark, feathery roots (right) of waterhyacinth.
Credits: Lyn Gettys, UF/IFAS

Waterhyacinth spreads by sexual and vegetative means. Seeds are tiny and remain dormant until germination is triggered by drying or by exposure to alternating warm and cold temperatures. Expansive growth and spread of waterhyacinth is due mostly to vegetative reproduction as mature plants rapidly produce new daughter plants from horizontal stolons. This vegetative strategy allows waterhyacinth populations to double in size in as little as 6 to 18 days. For example, assume that a single waterhyacinth is introduced to a body of water. A week later, two plants are present; after two weeks, four plants are present; after three weeks, eight plants; after four weeks, sixteen plants; and so on. After five months of this exponential growth, as many as 500,000 plants—enough to cover an acre of the water's surface—inhabit the system. The incredibly prolific growth of this species has earned waterhyacinth the dubious honor of being the most intensively managed floating weed in Florida (Langeland et al. 2014).

The prolific growth of waterhyacinth has caused enterprising individuals to wonder whether the species could be used for any number of economic purposes. For example, in 1897, Webber indicated that waterhyacinth could be used as a fertilizer or soil amendment and as a feed for hogs and cattle. It has been evaluated as a cellulose source in papermaking and is currently used in the production of furniture, baskets (Figure 3), and many other decorative items. None of these uses has been economically viable, but recent studies have focused on the use of waterhyacinth as a source of biofuel and for nutrient removal in sewage treatment plants and other nutrient-rich aquatic systems.

Figure 3. Basket made from waterhyacinth.
Credits: Carl Della Torre, UF/IFAS

Waterhyacinth grows almost entirely on the surface of the water, and its growth potential is limited only by temperature and nutrient availability. Dense floating mats can form an "island" that supports populations of grasses, herbaceous plants, and small trees, which can further strengthen the floating mat. Large waterhyacinth colonies greatly reduce water flow (Figure 4), which can interfere with irrigation and flood control efforts, and they can make boating, fishing, and swimming impossible. Also, dense populations block light penetration through the water column, which greatly reduces or prevents oxygen production by shading out submersed plants and phytoplankton, thus reducing oxygen concentrations to levels that are dangerous for fish and other aquatic wildlife.

Figure 4. Waterhyacinth infestation in a Florida canal.
Credits: Lyn Gettys, UF/IFAS

Control

The St. Johns River constituted a major shipping passage through Florida when waterhyacinth was first introduced to the state in the 1880s. In order to facilitate use of the St. Johns and make it available again for the commercial transport of goods, the US Army Corps of Engineers reportedly was authorized by the US Congress to use "any means necessary" to clear the system of these noxious weeds. Attempts to control floating waterhyacinths utilized applications of a wide variety of substances, including arsenic, sulfuric acid, and other toxic chemicals. Some of these substances effectively controlled waterhyacinths but proved toxic to cattle that grazed on treated plants. Feeding deterrents such as rotten eggs and manure were added to chemical applications to discourage grazing, but were ultimately ineffective or too expensive to use under operational conditions. After these disappointing results, resource managers were forced to resort to mechanical control—manually removing plants from the surface of the water and offloading them to shore—in their attempts to clear Florida's waterways. This method proved expensive and ineffective, as plants grew faster than they could be harvested from the system, but it was the only management tool available until the discovery of synthetic herbicides in the 1940s.

Waterhyacinth is now controlled in many regions via chemical means (e.g., herbicides), but this Brazilian native is still considered one of the world's worst weeds (Holm et al. 1997; Lowe et al. 2000) and is intensively managed in virtually all areas that the species has managed to invade.

The best way to control waterhyacinth is prevention or exclusion from aquatic ecosystems. Once waterhyacinths become established, there are a number of methods that can be used to control these noxious weeds. Mechanical harvesting and hand removal may be useful to prevent the spread of waterhyacinth plants to uninfested parts of a water body. Mechanical harvesting can be used to remove plants from large areas and involves specialized equipment. Hand removal usually involves raking plants to the shoreline or onto a boat but is very labor-intensive, since dense populations of waterhyacinth can weigh as much as 400 tons per acre. A problem associated with both of these removal methods is disposal of harvested plants; most harvested waterhyacinths have to be transported away from the water to farm fields or landfills, which can be an expensive proposition. Drawdowns—also called "dewatering"—can be used to "strand" and dry out waterhyacinths on exposed soils, but the time needed to dry large mats of plants can be long. Also, drawdowns trigger germination of waterhyacinth seeds, so new populations can become established quickly when water levels rise.

Several biocontrol agents—insects that feed exclusively on waterhyacinth—have been introduced in Florida and throughout the world. The stem-boring caterpillar *Niphograpta albiguttalis* was introduced from Argentina in 1977 and has become established throughout the southern United States, but provides a negligible level of control (Cuda 2020). The two most successful biocontrol agents—the waterhyacinth weevils *Neochetina eichhorniae* and *N. bruchi*—were introduced from Argentina to the United States in the early 1970s and have been released on waterhyacinth in 30 and 27 countries, respectively (Center et al. 2002). These weevils were introduced to Florida at around the same time and have become widely established throughout the state. The weevils slow plant growth and reproduction but do not provide complete control of waterhyacinth alone (Figure 5). The newest waterhyacinth biocontrol agent is the leaf hopper *Megamelus scutellaris*, which was approved for release in 2010 and is currently being released on waterhyacinth in Florida (Tipping et al. 2011). Stem-boring caterpillars, weevils, and leaf hoppers cannot be purchased for use as biocontrol agents, but fortunately they are well-established in most ecosystems that have been invaded by waterhyacinth.

Figure 5. Biocontrol insect feeding damage on waterhyacinth.
Credits: Phil Tipping, USDA ARS IPRL

Herbicides are commonly used in maintenance control programs to keep plant populations at acceptable levels and to reduce the growth of waterhyacinth. In fact, as mentioned earlier, waterhyacinths clogged the St. Johns River for decades after the species' introduction and were brought under control only when synthetic herbicides were discovered in the 1940s. As of 2020, there were 17 herbicide active ingredients labeled for use in aquatic systems in Florida (UF/IFAS CAIP 2020). Herbicide selection is based on water use, selectivity (to reduce damage to desirable native plants growing nearby), and cost. A number of herbicides can be applied as foliar sprays to selectively control waterhyacinth. Contact herbicides—including diquat, flumioxazin, and endothall—are quickly absorbed by plant tissue and are fast-acting, whereas systemic herbicides—including 2,4-D, glyphosate, imazamox, penoxsulam, and bispyribac—provide slower but effective control. For more information about efficacy of aquatic herbicides, please see EDIS publication AG262, *Efficacy of Herbicide Active Ingredients against Aquatic Weeds*, at https://edis.ifas.ufl.edu/ag262.

Neither biological control (insects) nor chemical control (herbicides) completely eradicates waterhyacinth populations when used alone. However, greenhouse trials have shown that herbicide rates can be halved without reductions in efficacy when biocontrol agents are present on waterhyacinth (Gettys et al. 2014; Tipping et al. 2017). Waterhyacinth weevils are ubiquitous in Florida, so this integrated management strategy can be employed throughout the state without augmented releases of biocontrol insects. Reducing herbicide usage results in significant savings; for example, resource managers in Florida treat around 40,000 acres of floating weeds (waterhyacinth and waterlettuce) annually and the historical treatment uses 4 quarts per acre of the herbicide 2,4-D. If managers continue to use 2,4-D and reduce the rate to 2 quarts per acre, this would reduce annual 2,4-D usage by 93,514 quarts (23,378.5 gallons) and save taxpayers over $280,000 per fiscal year.

Summary

Waterhyacinth is one of the world's worst aquatic weeds and is Florida's most intensively managed floating plant. This attractive, free-floating aquatic plant grows throughout the year in southern Florida but often dies back during the winter in the northern parts of the state. Waterhyacinth is cultivated as a water garden and pond plant, but cultivation, sale, and possession of this noxious weed is prohibited in Florida. Dense mats formed by this species interfere with human uses of water bodies and disrupt ecosystems by preventing penetration of light and oxygen into the water column. Although there are a number of control methods that may be used to manage populations of waterhyacinth, aggressive maintenance control programs that rely on herbicides and established biocontrol agents are most commonly used to keep populations of waterhyacinth at tolerable levels.

Literature Cited

Center, T. D., M. P. Hill, H. Cordo, and M. H. Julien. 2002. "Waterhyacinth." In *Biological control of invasive plants in the eastern United States*, edited by R. Van Driesche, B. Blossey, M. Hoddle, S. Lyon, and R. Reardon, 41–64. USDA Forest Service Publication FHTET-2002-04.

Cuda, J. 2020. "3.6.1: Insects for biocontrol of aquatic weeds." In *Biology and control of aquatic plants: a best management practices handbook*, 4th ed., edited by L. A. Gettys, W. T. Haller, and D. G. Petty, 145-150. Marietta, GA: Aquatic Ecosystem Restoration Foundation. Online at http://aquatics.org/bmp.html (accessed 20 November 2020).

FDACS DPI. 2020. Florida Department of Agriculture and Consumer Services Division of Plant Industry Noxious Weeds List (5B.57-007). Online at https://www.flrules.org/gateway/notice_Files.asp?ID=23639596

Flora of North America. 2020 (access date). "Flora of North America: *Eichhornia crassipes*." *FNA* 26:39–41. Online at http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=200027394.

Gettys, L. A., P. W. Tipping, C. J. Della Torre III, S. N. Sardes, and K. M. Thayer. 2014. Can herbicide usage be reduced by practicing IPM for waterhyacinth (*Eichhornia crassipes*) control? Proceedings of the 127th Annual Meeting of the Florida State Horticultural Society 127:213-217.

Holm, L., J. Doll, E. Holm, J. Pancho, and J. Herberger. 1997. *World weeds: natural histories and distribution*. New York: John Wiley.

Klorer, J. 1909. "The water hyacinth problem." *Journal of the Association of Engineering Societies* 42:33–48.

Langeland, K. A., F. M. Fishel, and L. A. Gettys. 2014. *SM-3 Aquatic Pest Control*. University of Florida Institute of Food and Agricultural Sciences.

Lowe, S., M. Browne, S. Boudjelas, and M. De Poorter. 2000. *100 of the world's worst invasive alien species: a selection from the global invasive species database*. The Invasive Species Specialist Group. Online at http://iucngisd.org/gisd/pdf/100English.pdf (accessed 6 February 2023).

Penfound, W. T., and T. T. Earle. 1948. "The biology of the water hyacinth." *Ecological Monographs* 18, no. 4: 447–472. http://www.jstor.org/stable/1948585 (accessed 23 July 2014).

Tipping, P. W., T. D. Center, A. J. Sosa, and F. A. Dray, Jr. 2011. "Host specificity assessment and potential impact of *Megamelus scutellaris* (Hemiptera: Delphacidae) on waterhyacinth *Eichhornia crassipes* (Pontederiales: Pontederiaceae)." *Biocontrol Science and Technology* 21:75–87.

Tipping, P. W., L. A. Gettys, C. Minteer Killian, J. Foley, and S. Sardes. 2017. "Herbivory by biological control agents improves herbicidal control of waterhyacinth (*Eichhornia crassipes*)." *Invasive Plant Science and Management* 10(3): 271–276.

UF/IFAS CAIP. 2020 (access date). "Herbicides registered for use in Florida waters." Online at https://plants-archive.ifas.ufl.edu/manage/developing-management-plans/chemical-control-considerations/herbicides-registered-for-use-in-florida-waters

Webber, H. J. 1897. *The water hyacinth, and its relation to navigation in Florida*. US Department of Agriculture, Division of Botany, Bulletin No. 18. Washington, D.C.: US Government Printing Office. Online at http://ia600406.us.archive.org/9/items/waterhyacinthits00webb/waterhyacinthits00webb.pdf (accessed 23 July 2014).