2.11 Waterhyacinth

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Pontederia (*Eichhornia*) *crassipes* (Mart.) Solms; floating plant in the Pontederiaceae (pickerelweed) family
Derived from *Eichhorn* [Johann Albrecht Friedrich Eichhorn (1779-1856), Prussian minister of education and public welfare] and *crass* (Latin: thick)
"plant with thick leaf stalks"

Introduced from Brazil to New Orleans in 1884
Present throughout the southeastern US and California, Hawaii and the Caribbean area

Introduction and spread

Pontederia crassipes (formerly *Eichhornia crassipes*) is native to the Amazon River and has been widely introduced throughout the tropical regions of the world, most recently occurring in Lake Victoria in East Africa. The first known introduction of waterhyacinth to North America was at the Cotton States Exposition in New Orleans in 1884. The species was initially cultivated as an ornamental but quickly escaped cultivation and invaded other parts of the

southeastern US. Waterhyacinth must have been a botanical curiosity due to its size, floating growth habit and the beauty of its very short-lived purple flower spikes. Mr. Fuller (the owner of Edgewater Grove, 7 miles upstream of Palatka on the St. Johns River) introduced this “beauty” to Florida around 1890. It was initially grown in Mr. Fuller’s fountain pond and excess growth was cast into the St. Johns River, where within a short time it covered the half-mile wide river from bank to bank at several locations. Waterhyacinth spreads very rapidly; for example, the species covered 126,000 acres of Florida’s surface water within 70 years of its arrival in that state. Waterhyacinth is present throughout

the southeastern US, California, Hawaii and the Virgin Islands, but is considered eradicated in Arizona, Arkansas and Washington State. Populations of waterhyacinth have been reported in other states, including New York, Minnesota, Kentucky, Tennessee and Missouri and plants are intentionally introduced to farm fish ponds in southern Arizona and southern Delaware. This species is not cold-hardy and has not established permanent populations in more temperate areas outside the southern US. Waterhyacinth will survive moderate freezes but requires temperatures of greater than 50 °F to produce new growth. A number of states, including Florida, South Carolina and the US territory Puerto Rico, prohibit the sale of waterhyacinth, but the species is still available for purchase from aquarium supply stores, aquatic plant nurseries and internet sources in other states. Waterhyacinth spreads in natural systems by producing seedlings and daughter rosettes – small plantlets that are attached to the mother plant by a floating stolon or runner. Rosettes can easily become caught in boat trailers or live wells, which results in the introduction of the species to new bodies of water. Waterhyacinth is also spread by uninformed water garden and pond owners, who (along with Mr. Fuller in the 1890s) believe they are beautifying canals and lakes by tossing extra plants into natural systems.

Description of the species

Waterhyacinth is a floating flowering monocot that grows as an annual (in temperate regions) or as a perennial (in tropical and subtropical climates) in all types of bodies of water. Muddy or turbid water often limits growth of submersed plants, but because waterhyacinth is a floating plant, it is unaffected by these conditions. The leaves of waterhyacinth are thick, glossy, waterproof and rounded with a heart-shaped base. Each leaf can reach up to three feet in length and is borne singly on a spongy, inflated petiole (leaf stalk). Leaves are attached to one another at the base of the petiole to form a rosette that is free-floating, although plants will sometimes root in soft saturated sediments when stranded by drought or wave action. The dark purple to black roots of waterhyacinth are long and feathery and hang beneath the rosette of leaves. Waterhyacinth grows throughout the year in the tropics, but freezing temperatures kill the leaves of the plant in the northern portions of its range. Cold-damaged leaves then fold down and protect the meristem, which grows at or immediately below the surface of the water.

The most striking feature of waterhyacinth is the spike of large, showy flowers produced from the center of the rosette of leaves. Flowers are borne in groups of 8 to 15 on a single spike that can rise up to 20 inches above the rosette. Each flower is up to 3 inches tall and has six lavender-blue to purple petals, with the uppermost petal marked by a yellow “eye-spot”. Flowers are short-lived, with each lasting only one or two days, but a spike may be showy for up to a week since only a few flowers open each day. Flowering is indeterminate – flowers at the base of the spike open first and flowers at the top of the spike open last. After flowers are fertilized, the spike bends and dips into the water, where many tiny seeds are produced in capsules. Mature seeds drop to the bottom of the body of water, where they remain dormant until sediments are exposed after water levels fall due to drought.

Waterhyacinth is sometimes confused with native frog’s-bit (*Limnobium spongia*), because both are floating plants with rounded leaves borne in rosettes. However, the roots of waterhyacinth are black and feathery, whereas the roots of frog’s-bit are thicker and white. In addition, the petioles of frog’s-bit are usually slender, while the petioles of waterhyacinth are often spongy and bladder-like. Finally, flowers of frog’s-bit are small, white and much less showy than those of waterhyacinth.

Reproduction

Waterhyacinth spreads by both seed and vegetative reproduction. As noted above, seeds are tiny and remain dormant until conditions are favorable for germination. Some reports suggest that seeds germinate best after they have dried and others say that seeds must be exposed to alternating warm and cold temperatures before they will germinate. Seed

reproduction can be important in temperate climates since waterhyacinth is killed by freezing temperatures and recolonization in spring may be dependent on the seed bank established during the previous growing seasons. Once seeds have germinated and conditions are favorable for growth, waterhyacinth rapidly produces new daughter plants, or ramets, from horizontally growing stolons. Daughter plants can be produced in as little as 5 days under optimal growing conditions and populations can double in size in as little as 6 to 18 days, so the rapid growth and spread of waterhyacinth is due primarily to this type of vegetative reproduction.

Problems associated with waterhyacinth

Waterhyacinth grows almost entirely on the surface of the water as a floating plant and its growth potential is limited only by temperature and the availability of nutrients. Waterhyacinth prefers an environment similar to that favored by desirable fish populations – mesotrophic and eutrophic habitats with an adequate supply of calcium and a pH ranging from 6.5 to 9.5. There is no doubt that waterhyacinth is a serious aquatic weed. Under optimum conditions, an undisturbed population of waterhyacinth is composed of about 10 plants per square foot and has a fresh weight of 10 pounds. An acre (43,560 square feet) of waterhyacinth would therefore be home to about 435,600 plants with a fresh weight of around 200 tons. Since 95% of the plant weight is attributable to water, only 5% of the fresh weight – about 10 tons per acre – remains after plants are harvested and dried.

Waterhyacinth may not be as productive as most agricultural crops; however, trying to remove or stop 200 tons of live waterhyacinths from jamming against a bridge or clogging a waterway is no simple task! Large colonies of linked mother and daughter plants form dense rafts or mats that can quickly cover a body of water from shore to shore. Left undisturbed, floating mats of waterhyacinth provide a perfect substrate or “island” to support the growth of additional grasses, herbaceous plants and even small trees, which further bind the floating mat together. These mats interfere with human use of waters. For example, large populations of waterhyacinth can restrict recreational and commercial activities and can make boating, fishing and swimming impossible. In addition, water flow is greatly reduced where mats of waterhyacinth are present, which can impede irrigation and flood control efforts. Infestations of waterhyacinth can have serious ecological impacts as well. Dense waterhyacinth populations also reduce species richness or plant diversity by limiting light availability to native submersed plants and by crushing communities of emergent plants along the shoreline. The loss of these plants also eliminates habitats for animals that depend on native plants for shelter, nesting and food. In addition, large mats block the air-water interface and reduce dissolved oxygen, which makes the system uninhabitable to fish and other aquatic fauna.

Management options

The best method to control waterhyacinth is to prevent the species from entering a water body. The sale and interstate shipment of a closely related species [rooted waterhyacinth (*E. azurea*)] is prohibited by the Federal Noxious Weed List and its introduction into the US has been avoided thus far. Waterhyacinth (*P. crassipes*) is not on the Federal Noxious Weed List because the species was already widely distributed in the US at the time the Federal Noxious Weed Acts were developed. In spite of these prohibitions, waterhyacinth still manages to slowly increase its range and to colonize new bodies of water.

Physical (Section 3.4) or mechanical (Section 3.5) control measures such as hand removal or mechanical harvesters should be designed to prevent the spread of waterhyacinth plantlets to other parts of the water body. Hand removal is labor-intensive and typically involves raking plants to the shoreline or into a boat. This very laborious task can seem deceptively easy; a pond that is a single acre in size may look small, but can host up to 200 tons of waterhyacinth that must be pulled out by hand! Plants are then offloaded along the shoreline until they desiccate and die. Hand removal may be an effective means to control waterhyacinth in small ponds, but is not practical in larger systems. Mechanical harvesting is usually used to remove plants from larger systems and involves heavy machinery that ranges from a backhoe on a barge to specialized equipment. A problem associated with mechanical harvesting of waterhyacinth is disposal of the harvested plants. Waterhyacinth vegetation has been used to make furniture, baskets and other items in some parts of the world and has been evaluated for its potential as mulch, cattle feed, biofuel production and other uses, but its utility is very limited. As a result, most harvested waterhyacinth is generally disposed of in farm fields or a landfill. Hand removal of waterhyacinth from ponds is best employed after herbicide application has been used to control the majority of the plants. Regular removal of missed plants and any plants growing from seeds after herbicide treatment will prevent waterhyacinth from reinfesting the pond.

Drawdowns can be used to "strand" and desiccate waterhyacinth on exposed shorelines, but the time required to effectively dry large mats of plants can be long. Also, drawdowns and drought have been known to trigger seed germination and plants reestablish quickly when water levels rise. Therefore, most waterhyacinth management programs in the US rely on the use of herbicides in conjunction with established insect biocontrol agents. Waterhyacinth weevils (*Neochetina* spp.) were introduced and established in the early 1970s (Section 3.6.1). The weevils are found throughout the range of waterhyacinth but in most areas the insects only slow plant growth and reproduction and do not provide adequate control of the weed. As a result, herbicides are used in maintenance control programs to keep plant populations low and to reduce growth potential of waterhyacinth. Herbicide selection is based on water use, selectivity to reduce damage to nontarget native plants and cost (Section 3.7.1). Several herbicides are commonly used 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.

Summary

Waterhyacinth is one of the world's worst aquatic weeds and causes problems in all tropical and subtropical continents. Its current distribution in the US is primarily from East Central Texas to the Atlantic Coast and north to coastal North Carolina. It also occurs in the Sacramento River Delta in California. Although waterhyacinth is occasionally found north of the central US, the species typically does not persist where waterways are subject to ice formation and prolonged freezing temperatures. Florida and the Gulf states are particularly impacted by waterhyacinth due to the moderate climate and shallow, naturally nutrient-rich lakes, but the species can colonize virtually any region in North America where winter temperatures remain above freezing and mesotrophic or eutrophic waters are present. Aggressive maintenance control programs have kept populations of waterhyacinth in check in most areas, but these efforts must be employed on a continual basis to avoid population explosions of this noxious invasive species.

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