

East Indian Hygrophila: *Hygrophila polysperma* (Roxb.)

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Introduction

East Indian hygrophila, also known as Miramar weed, Indian swampweed, and hygro, is an invasive aquatic plant that grows under submersed and emergent conditions. The species' center of origin is unclear, but it is thought to be native to the East Indies, India, Malaysia, and Taiwan (UF IFAS CAIP 2015). Although many species of *Hygrophila* are found throughout the world, only the introduced species *H. polysperma* and *H. corymbosa* as well as the native *H. costata* are found in Florida. East Indian hygrophila is classified by the USDA as an obligate wetland plant, meaning it almost always occurs in flooded or wetland habitats as opposed to more terrestrial environments (USDA NRCS 2015). The species is a federally listed noxious weed (USDA NRCS 2015) and a Florida Class II prohibited aquatic plant (FDACS DPI 2015). Class II Prohibited Aquatic Plants may be grown by registered nurseries but shipped only to customers outside of Florida. However, East Indian hygrophila's status as a federal noxious weed means that nurseries must also obtain a federal permit for interstate movement and a state permit for culture of the species. Accordingly, the UF/IFAS Assessment of Non-Native Plants in Florida's Natural Areas lists East Indian hygrophila as a prohibited plant (UF/IFAS Assessment 2016).



Figure 1. Emergent growth of East Indian hygrophila.

Credits: Lyn Gettys, UF/IFAS

East Indian hygrophila was first introduced to the United States as an aquarium plant around 1945. It was cultivated by an aquarium dealer in Ohio at the end of WWII and was originally called “oriental ludwigia” (UF IFAS CAIP 2015). The first recorded sighting of East Indian hygrophila in Florida occurred near Tampa in 1965, but the species was misidentified until 1977 (Les and Wunderlin 1981). By

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1980, East Indian hygrophila had become a weed problem in south Florida canals, and by 1994, it had spread to 18 of Florida's public bodies of water (UF IFAS CAIP 2015).

Classification

Common Names: East Indian hygrophila, hygrophila, Miramar weed, Indian swampweed, hygrophila

Scientific Name: *Hygrophila polysperma* (Roxb.) T. Anderson

Family: Acanthaceae (waterwillow family) (USDA NRCS 2015)

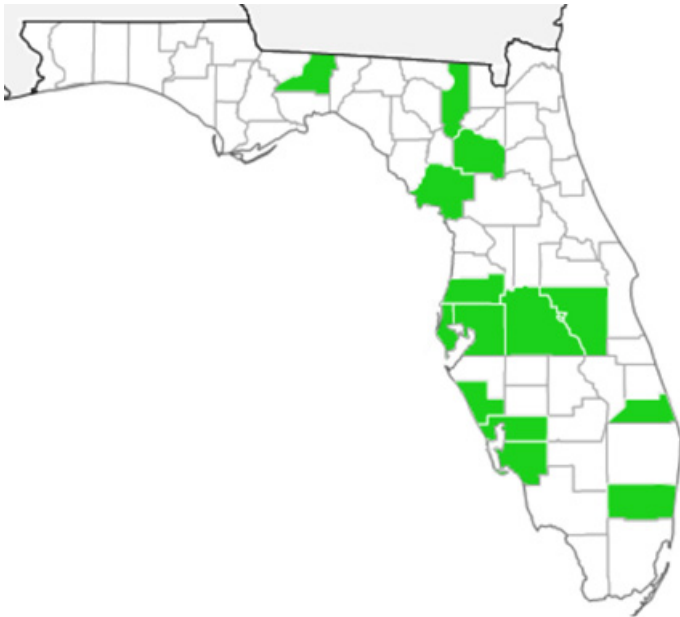


Figure 2. Distribution of East Indian hygrophila in Florida. Credits: EDDMapS. 2015. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at <http://www.eddmaps.org/>; last accessed March 7, 2015.

Description and Habitat

East Indian hygrophila is established in freshwater systems in more than a dozen counties in Florida. It is likely present but unreported more widely throughout the state. Populations also occur in Texas, Alabama, South Carolina, Kentucky, and Virginia (EDDMapS 2015).

The species is most commonly found growing under submersed conditions with the uppermost part of the plant emerging above the water, but plants can also grow along shorelines and other areas with wet soil. It prefers to grow in areas of moving water such as streams and canals, but it also grows in still waters where little flow occurs.



Figure 3. Submersed growth of East Indian hygrophila. Credits: David Sutton, UF/IFAS

East Indian hygrophila has square stems and leaves that are attached in pairs opposite one another along the stems. The species forms dense, low-growing, and creeping mats along shorelines and in other emergent conditions. Stems can grow up to 10 feet long under submersed conditions. Submersed leaves are lanceolate (sword-shaped) to elliptic, up to 2 inches long, thin, and attached to the stem by a short petiole (leaf stalk). In contrast, leaves on emergent growth are usually shorter, thick, fleshy, and sessile (attached directly to the stem without a petiole). Leaf color in both forms varies, ranging from green to brown, bronze, and red. Emergent leaves and stems are often covered with dense hairs, but submersed growth is usually smooth and hairless (Sutton 1996).

Flowers of East Indian hygrophila are produced only on the emergent growth that occurs along shorelines and on “topped-out” submersed populations with aerial stems. Flowers are small (up to 0.375 inches across), blue to white, and attached directly to upper parts of the stems in the leaf axils. The flowers have two “lips” or petal-like structures, and the lower lip has three lobes. East Indian hygrophila flowers from October to March in Florida. Plants produce copious amounts of tiny seeds in a narrow capsule that is up to 0.75 inches long. The importance of seed production for establishment and spread of this species is unknown (Sutton 1995).



Figure 4. Flower of East Indian hygrophylla.
Credits: David Sutton, UF/IFAS

Small fragments and sections of leaves will readily produce roots and form new plants (Peters 2001). It is likely that the plant's spread and colonization of new areas occur mostly through vegetative means because the stems of East Indian hygrophylla are somewhat fragile and easily break into fragments.



Figure 5. Capsule with seeds (left), seedlings (center), and rooted leaf fragment (right) of East Indian hygrophylla.
Credits: David Sutton, UF/IFAS

Similar to other submersed weeds, dense populations of East Indian hygrophylla can cause a number of significant problems in aquatic ecosystems. Submersed weeds such as East Indian hygrophylla may go unnoticed until they form surface mats. By this point, plants have been growing unchecked, sometimes for months, and the water column has been filled with plant material. East Indian hygrophylla and other submersed weeds also grow very quickly. For example, an infestation of East Indian hygrophylla on Lake Tohopekaliga in central Florida expanded from 0.1 acres in 1979 to at least 10 acres in 1980 (Vandiver 1980). As a result, these species frequently outcompete native aquatic plants and form dense monocultures (populations of a

single species) that are poor habitats for aquatic fauna, most of which require a diverse environment in order to thrive. Dense plant growth can also trap heat. This raises the temperature of surface water and depletes dissolved oxygen in the shaded lower portion of the water column, resulting in conditions that negatively impact fish. Robust populations of East Indian hygrophylla can obstruct water flow in flood-control canals, which can have serious consequences if resource managers need to quickly move large volumes of water to prevent flooding during tropical storms, hurricanes, and other severe weather events. Large mats of fragments may also collect at culverts and interfere with water control pump stations. Recreational uses of infested waters are limited as well. For example, boat motors quickly become clogged with weeds, and fishing lines can snag shortly after being cast.



Figure 6. An attempt to operate an outboard motor in dense, topped-out East Indian hygrophylla.
Credits: David Sutton, UF/IFAS

Control

Sources quoted by Vandiver in 1980 indicated that East Indian hygrophylla was a popular aquarium plant and had been found at a number of geographically separated sites throughout Florida, including Miramar and Margate (Broward County), Conservation Area 3 and the Palm Beach County Canal (Palm Beach County), the Hillsborough and Alafia Rivers near Tampa (Hillsborough County), East Lake Tohopekaliga near Orlando (Osceola County), and ponds and canals in Lee County. It is probable that East Indian hygrophylla made its way into Florida's waters as a result of multiple aquarium dumps around the state. This type of intentional introduction has been implicated in the establishment and spread of other aquatic weeds as well, including the relatively new invader *rotala* (*Rotala rotundifolia*) (Gettys and Della Torre 2014). Clearly, the most effective way to avoid the problems associated with East Indian hygrophylla and other invasive plants is exclusion, or preventing them from entering uninfested aquatic systems. Unfortunately, a surprising number of aquarium

owners remain unaware of the ecological consequences associated with the release of introduced species into public waters. Although intentional release was most likely the vector for initial introductions of East Indian hygrophylla, accidental transfer of this and other submersed species frequently occurs when boats, trailers, and other equipment are moved from an invaded site to an uninfested one. Therefore, anything that has been used in waters where East Indian hygrophylla is present should be carefully inspected before being moved to another aquatic system. Any plant fragments must be removed to prevent the introduction of this noxious weed to uninfested bodies of water (Gettys et al. 2013).



Figure 7. East Indian hygrophylla near a water control structure.
Credits: David Sutton, UF/IFAS

Once East Indian hygrophylla has been discovered in an aquatic system, swift action must be taken to control the weed and reduce or prevent its impacts. Although hand pulling and mechanical removal are useful techniques for the management of certain aquatic weeds, these methods create a significant number of fragments that may actually spread infestations of East Indian hygrophylla. Therefore, these methods are not recommended. Certain aquatic weeds can be managed using biological control agents that are either host-specific (only attacking a single species) or generalist (attacking many species). There are no biological control agents that only attack East Indian hygrophylla. In addition, the generalist triploid grass carp (*Ctenopharyngodon idella*) devours a wide variety of aquatic plants, but does not consume or cause measurable damage to East Indian hygrophylla. Therefore, the primary means

of management for this noxious weed is chemical control through the use of herbicides.

Previous reports stated that East Indian hygrophylla was tolerant of most herbicides labeled for aquatic use and that this species was more difficult to control than hydrilla (*Hydrilla verticillata*), which is Florida's most intensively managed submersed weed (Hall and Vandiver 1990). For example, products containing the active ingredient endothall have limited activity on East Indian hygrophylla and are used mostly for suppression. However, the protox inhibitor flumioxazin (labeled for the aquatic market in 2011; marketed as Clipper® and Schooner™) reportedly provides good control of East Indian hygrophylla at 200 to 400 ppb (Valent 2012). Flumioxazin is very sensitive to water pH. It breaks down quickly when pH is greater than 8.5, so it should be applied early in the morning (or even before dawn if possible) in high-pH waters to lessen the likelihood of reduced efficacy. If the diluent (tank/mix water) has a pH equal to or greater than 7, it may be useful to add a buffering agent to decrease the tank solution to a pH of 5 to 7. Also, because flumioxazin is a contact herbicide, retreatment of infested waters is often recommended to ensure that any plant material surviving initial treatment is controlled by a subsequent application.

Summary

East Indian hygrophylla is a submersed aquatic weed that has invaded a number of aquatic systems in the southeastern United States. The species was initially cultivated in Florida as an aquarium plant and was likely introduced to Florida's waters through multiple aquarium dumps. East Indian hygrophylla is a federally listed noxious weed and a Florida Class II prohibited plant, meaning cultivation, sale, and possession of this species without state and federal permits are prohibited in Florida. Established populations of East Indian hygrophylla interfere with human uses of bodies of water and disrupt ecosystems by forming dense, impenetrable monocultures that clog the water column, restrict water flow, and create poor habitat for aquatic fauna. There are few options for management of East Indian hygrophylla because techniques that cause fragmentation can actually spread the species. However, the herbicide flumioxazin appears to provide acceptable control of this noxious weed when used according to label directions.

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