

Identification And Distribution Of Certain Similar-Appearing Submersed Aquatic Weeds In Florida¹

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The correct identification of a problem aquatic weed is one of the first steps in an aquatic weed control program. Taxonomists, biologists and laymen can be confused when trying to identify certain aquatic weeds in Florida. The confusion has occurred among several problem producing weeds because of the recent introduction of hydrilla (*Hydrilla verticillata* Casp.) into the State. Hydrilla (also known as Florida elodea) looks much like American elodea (*Elodea canadensis* Michx.) and in fertile waters it is often confused with egeria (*Egeria densa* Planch).

Hydrilla was first observed in 1960 growing in a canal near Miami and in springs near Crystal River, Florida. Taxonomists erroneously identified it as American elodea. The plant spread rapidly until in 1967 it was reported to be a major submersed aquatic weed in Florida (4). Research scientists observed the unusual growth characteristics of the plant and the difficulty of controlling it with aquatic herbicides. The above-soil portions of the plant could be completely removed by mechanical or herbicidal methods, but the area would be rapidly reinfested from small propagules and rootstock nodes. The heretofore unobserved, propagules produced by the plant prompted scientists to have Dr. Harold St. John, a recognized authority on the *Elodea* genera, to correctly identify the plant.

Numerous similar-appearing specimens having different growth characteristics were collected from many areas of the State and forwarded to Prof. St. John. The unidentified plant was identified as belonging to the genus *Hydrilla* and not *Elodea* or *Egeria*.

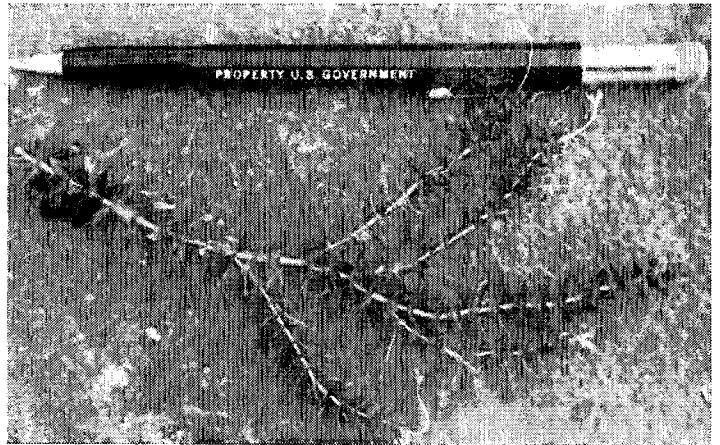
This report presents information on identification, distribution and status of problem of hydrilla, egeria and American elodea in Florida.

Identification

The three submersed aquatics will be discussed individually and the identifying characteristics compared. It is important that the aquatic applicators be able to identify the plants correctly. To accomplish this, one must be able to differentiate among the three plants.

HYDRILLA, *Hydrilla verticillata* Casp.: Hydrilla is a submersed vascular aquatic plant, rooted to the bottom and having long, branching stems. Lower leaves are opposite and small, whereas the median and upper leaves are in whorls of 4 to 8. Leaves are verticillate, narrowly lanceolate, spreading 1-nerved, 1-2 cm long, 1.5-2 mm wide,

serrate and ending in minute spine. Flowers arise from a spathe formed near the stem apex (3). They are found at or near the water surface. The entire flower is inconspicuous, measuring no more than 4 to 5 mm across the width of a threadlike pedicel (Figure 1). Seed formation, if it occurs at all, is poor. Reproduction is both vegetative and by fruits. Broken shoots develop into new plants that attach themselves in the hydrosol by fine filiform adventitious roots. Plants also produce subterranean shoots (termed "stem tubers") with swollen tips, densely clothed with fleshy, acute or acuminate scale-like leaves (4). An additional propagating structure, "the turion", is also produced by hydrilla (Figure 2).



A



B

Figure 1. A. Stem of hydrilla showing the single flowers on threadlike pedicels emerging near stem apices. B. Close-up of hydrilla flower.

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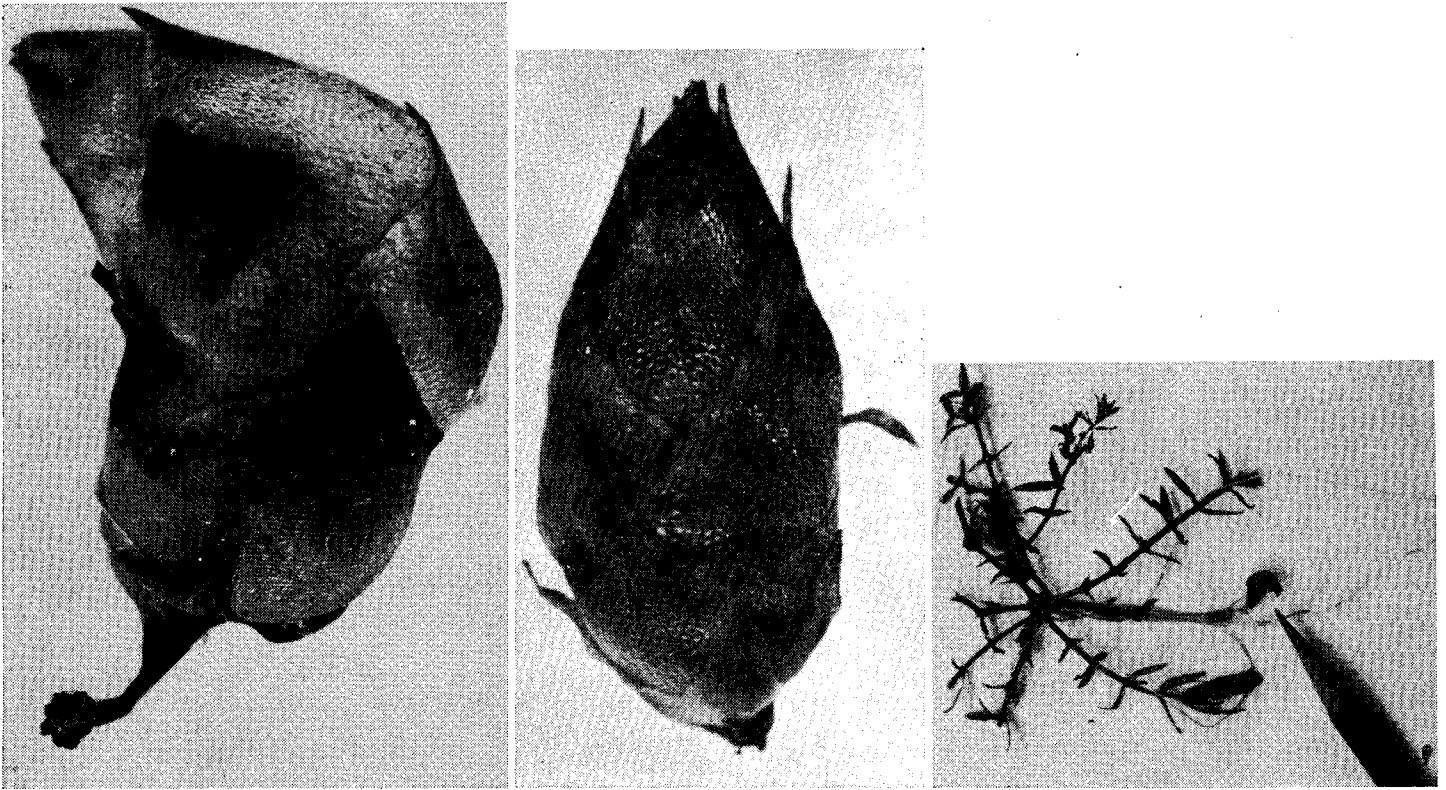


Figure 2. A. Close-up of a hydrilla "stem tuber" (15 x). B. Close-up of a hydrilla turion (15 x). C. Young plant formed from a "stem tuber" ($\frac{1}{2}$ x).

In taxonomy keys, elodea and hydrilla seem readily identifiable, but plants without flowers are very difficult to distinguish. Hydrilla is referred to as an Old World genus and elodea as a New World genus. St. John states that hydrilla is superficially very similar to elodea, but the pistillate flowers are epigynous (inferior ovary) in contrast to hypogynous flowers (superior ovary) of elodea (1, 3, 6, 8). Elodea also has a 2-lobed style and 3-9 stamens, while hydrilla has an entire style and 3 stamens (5). This means that hydrilla flowers are never perfect, whereas those of elodea may sometimes be perfect. It is readily apparent that it is even difficult for the taxonomist to distinguish between hydrilla and elodea with the best of flowering material. The only vegetative characteristic that may be used to distinguish between the two genera is the comparatively more copiously-toothed leaves of hydrilla although elodea may often have similar teeth (Figure 3).

Hydrilla is found in canals, ditches, pools, lakes, marshes, slow streams, rivers and tidal water areas, particularly in calcareous sites (10). It will grow in water 6-7 m deep and produce very dense mats of vegetation. Large infestations of hydrilla are common in many areas of Florida so dense that birds and other small animals can walk over the vegetation (Figure 4).

This plant is found in Russia, Australia, Central Africa, East Asia, East Germany, India and many other areas of the world. Only recently has it become established in Florida, southern Georgia and Alabama.

EGERIA, *Egeria densa* Planch: Egeria is a submersed plant that appears to the layman to be a larger version of hydrilla and elodea. Egeria and elodea are closely related,

obviously more closely related than either is to any other genus. Taxonomists are still discussing whether egeria and elodea are different genera. The general growth characteristics are very similar, but with several key differences.

Egeria has short internodes, leaves large and crowded and its growth is lush and vigorous. The lower leaves may be either opposite or in whorls of 4-7. The upper leaves may be 1-4 cm long and up to 5 mm broad and in whorls of 4-8. There is a single midrib and the thin, bright or pale green leaves are translucent (Figure 5).

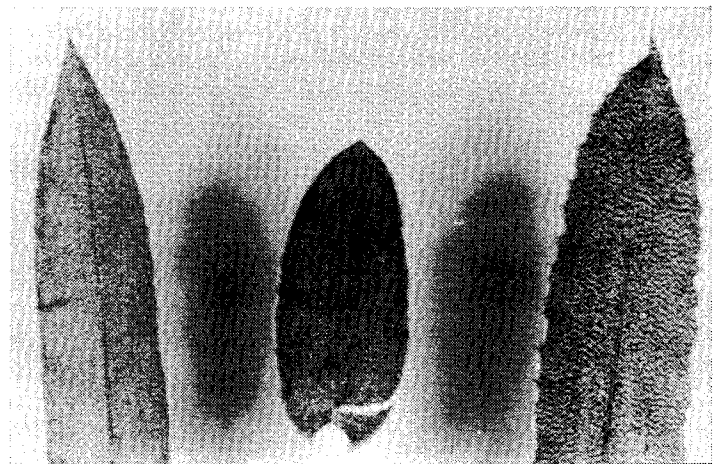
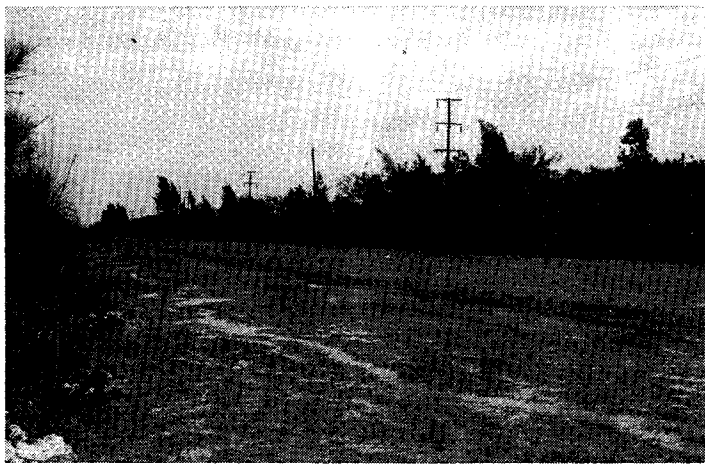
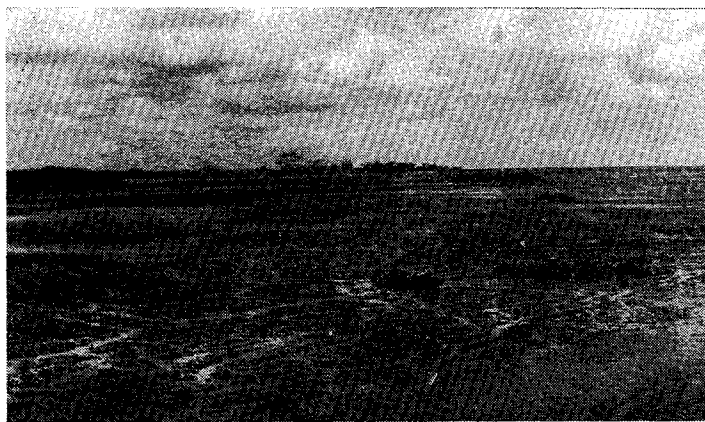


Figure 3. A close-up (10 x) of the terminal leaves of hydrilla (right), American elodea (mid) and egeria (left).



A



B

Figure 4. A dense infestation of hydrilla in A. flood control canal and B. wildlife refuge.

Flowers are strictly dioecious and are raised above the water (7). An important characteristic is the 2-4 flowers that rise from a single spathe, compared to the single flowers of elodea and hydrilla. The yellowish-white petals are about 1 mm long and may extend on the pedicel 2 cm above the water (Figure 6). The pistillate sex is rare.

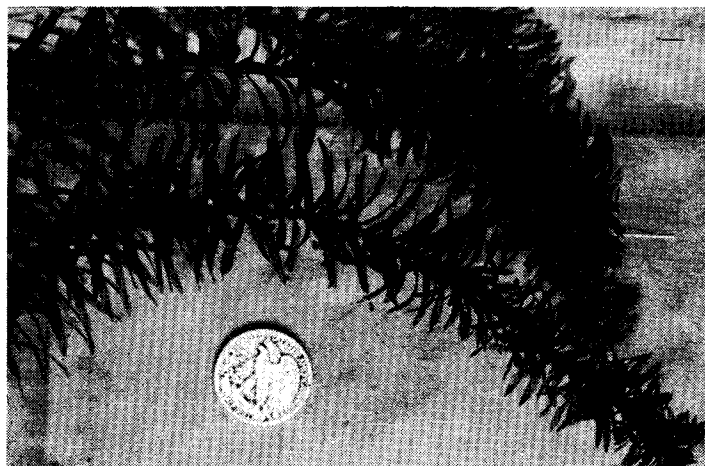
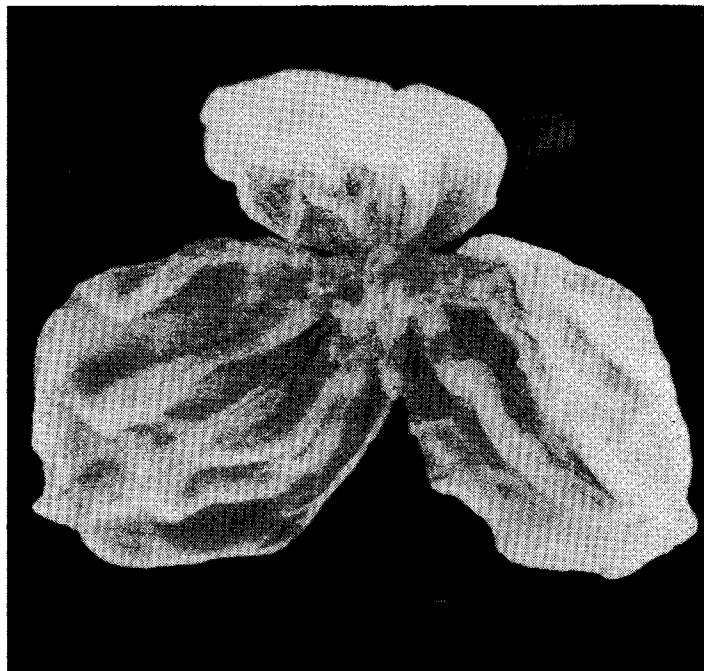


Figure 5. Stems of egeria showing short internodes and bushy growth of leaves ($\frac{1}{2}$ x).

Seeds are known in egeria, but they are uncommon. Dispersal of the plant by seed is believed to be of relatively minor importance. Floating plant fragments and lateral growth of rootstocks are the major method of dispersal. Stems exposed to air for 23 hours and then replaced in water have been observed to recover in one day.

This plant, the prettiest of the three genera, is the most common aquatic plant sold in the aquarium trade. It is native to South America but infestations are probably almost worldwide. Egeria is a problem mostly in the slow-flowing, spring-fed rivers, canals and lakes. (Figure 7).



A



B

Figure 6. A. Close-up of the flower of egeria (10 x) and B. the important identifying characteristic 2-4 female flowers that arise from a single spathe (1 x).

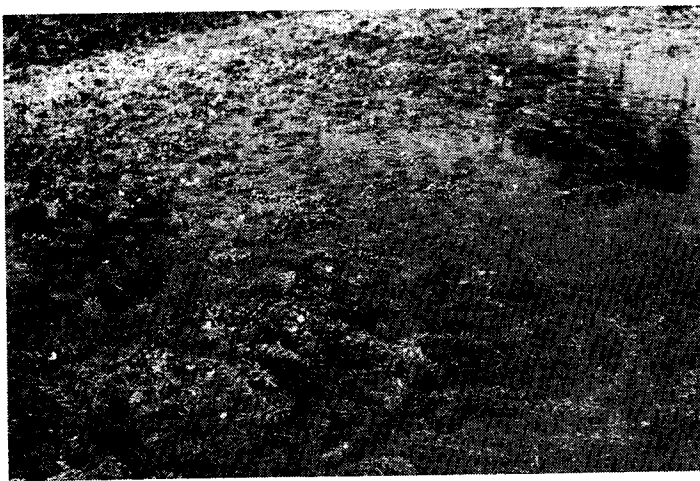


Figure 7. A dense infestation of egeria in the Withlacoochee River. Note the white flowers on the surface.

AMERICAN ELODEA, *Elodea canadensis* Michx.: It is a submersed aquatic rooting to the bottom, or free floating (when broken loose). The growths are erect until they reach the surface of the water. Roots are slender, white or pale and unbranched. Adventitious roots are freely produced from nodes of the stem and most abundantly so on detached, drifting branches. The lowest leaves are alternate, opposite or in whorls of three and much smaller than upper ones. The middle and upper leaves are opposite or in whorls of 3-7. They are from linear to oblong, acute or obtuse, sharply serrulate, 1.2-4 mm wide and 4-5 cm long. The flowers are solitary, axillary and perfect. The staminate flower about 4-5 mm long, remaining attached by a long peduncle (Figure 8). Like nearly all species of *Elodea*, this one is dioecious.

Seeds are rare in this species thus they are a minor method of dispersal. Plant fragments seem to be the main method of dispersal. Stems removed from the water and exposed to air for 23 hours and then replaced in water have recovered in one day. Rootstock of this plant has been found in the nest of several species of birds. Such deliberate or accidental spread by birds is apparently a principal means of propagation.

Elodea is common in ponds, slow-flowing streams and lakes, and is often found in calcareous waters. It is found throughout the Northeast and Midwest, localized in some western states, Canada, South America and other areas of the world.

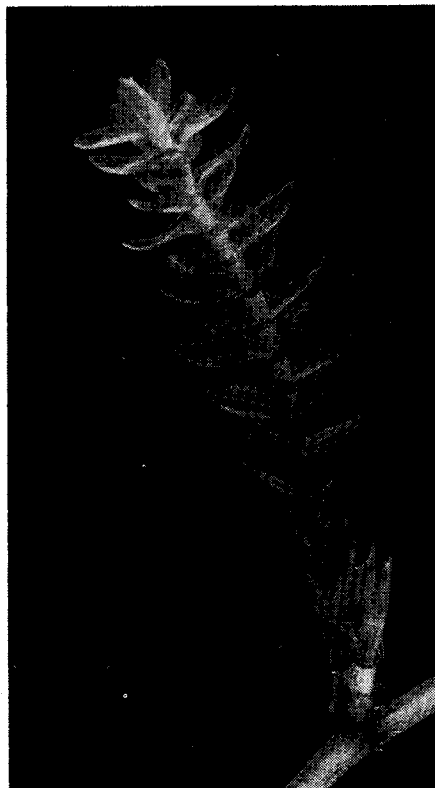
Distribution in Florida

Hydrilla has spread over Florida since its introduction in 1960 (Figure 9). The largest infestations are located along the southeast coast in the slow-flowing canals and conservation areas, central area in the clear water lakes and along the central west coast in the clear water springs and rivers.

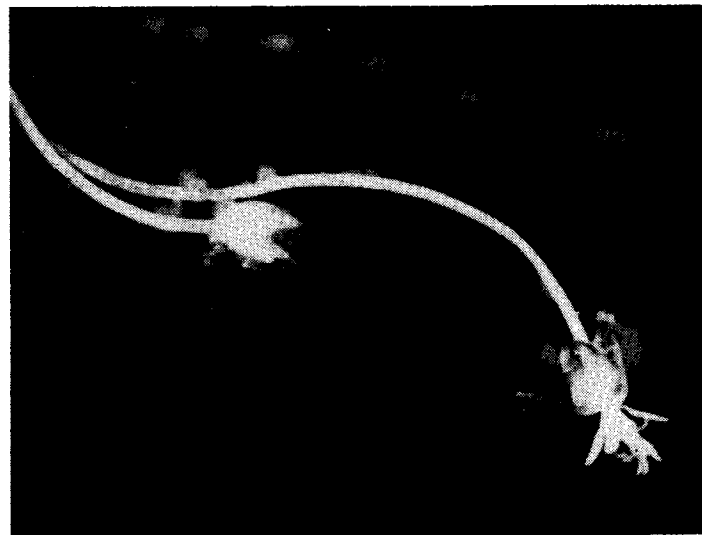
The plant was planted by tropical aquatic plant dealers on the west coast in 1958 and the southeast coast in 1959. It established rapidly and a conservative estimate of 35,000 infested acres was reported in 1967. Fragments of the plant have been observed in about all areas of the State.

The largest infestations of egeria are restricted to the central area of the State (Figure 9). Being the most com-

mon aquatic plant used in the aquarium trade, it has been planted in almost all areas of the State. However, it has established only in the clear slow-flowing spring-fed areas. The only exception to this is the small infestation along the east coast at Vero Beach where it is established in two shallow canals. Commercial harvesting of egeria is very common in the Central Florida area. It is shipped from this point to all areas of the United States. *Egeria* was estimated to infest 7,000 to 10,000 acres in 1967. American



A



B

Figure 8. A. Close-up of a branch of American elodea (1.5 x). B. Female flower of American elodea on elongated pedicel (2 x).

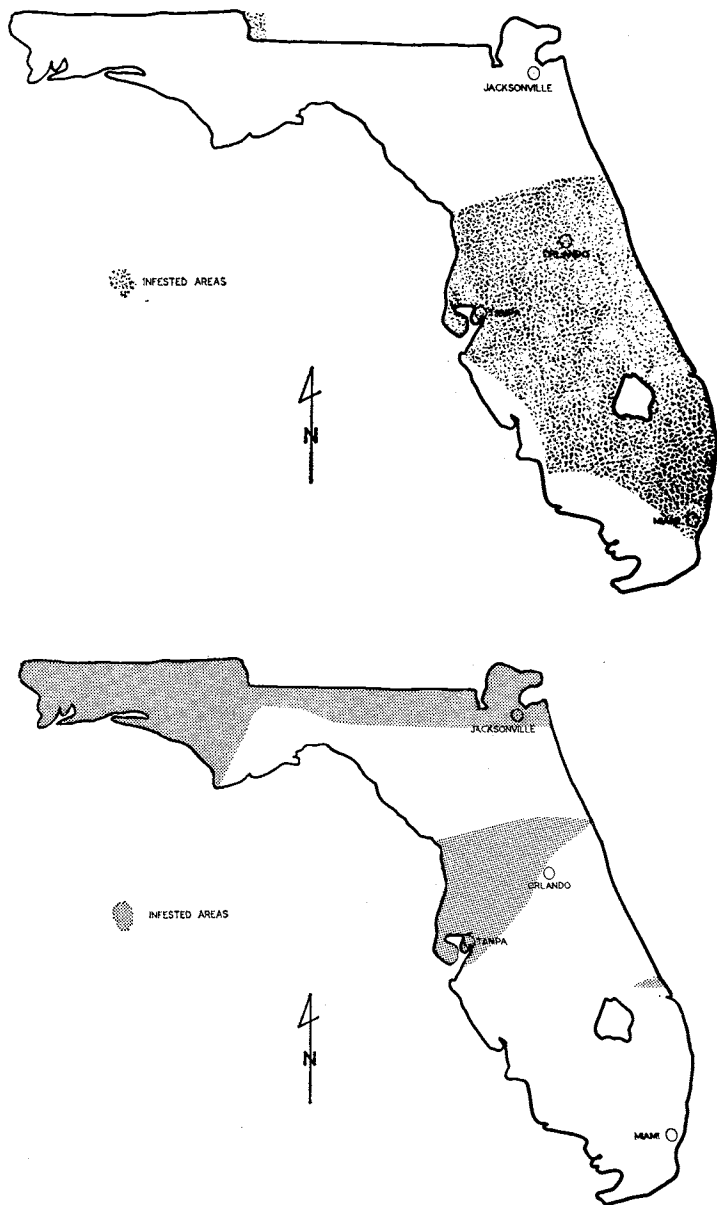


Figure 9. Distribution of hydrilla (A) and egeria (B) in Florida.

elodea is not found in the State, even though it has been reported in the State's flora.

Discussion

Hydrilla and egeria are now well-established in Florida. They are submersed vascular aquatic plants which produce dense mats of vegetation and often dominate the water where they grow. They stop water flow in canals and streams; impede recreational activities such as boating, water skiing, swimming and fishing; affect navigation and limit the appeal of the water areas for tourists.

Florida does not have American elodea. Records show that no indigenous species of American elodea occurs in Texas, South Carolina, Georgia, Florida or Louisiana (8). Attempts to grow this plant in greenhouse and laboratory have not been very successful in Florida.

Hydrilla presents the greatest problem and is the most widely spread of the two genera in Florida. It appears to have a much wider range of adaptability. The rapid regrowth of the plant from stem tubers and turions after herbicidal control makes it the most troublesome submersed aquatic plant in the State. When growing in association with other submersed aquatic weeds it usually establishes as the dominate vegetation after mechanical or herbicidal control. This is the result of the rapid regrowth from the tubers and turions (2).

Florida is faced with a complex problem of how to control hydrilla. Mechanical and herbicidal methods give only a temporary control. The rapid buildup of underground tubers and turions, which are highly resistant to herbicides, assures the continued survival of the plant in Florida waters.

The future of Florida's and other Southern States' water resources could depend on the action taken on hydrilla in the next few years. Research is urgently needed on this plant. A review of world literature has shown that there is little published research on hydrilla. A successful control must be found and then utilized in a program. The importance of preventing the future spread of this aquatic weed in the United States must be emphasized. There is no reason why this plant cannot become a problem in many areas of the United States

Abstract

Hydrilla (*Hydrilla verticillata* Casp.) and egeria (*Egeria densa* Planch) are described and compared with American elodea (*Elodea canadensis* Michx.). The distribution of these submersed aquatic weeds in Florida is discussed. Hydrilla was first reported in the United States in 1958 along the west coast of Florida. The plant now infests an estimated 35,000 acres and has spread over much of the entire State and into Southern Alabama and Georgia. Egeria infests an estimated 10,000 acres in Central Florida. Many lakes, ponds, canals and rivers have become useless for recreation, navigation and flood control because of these two aquatic weeds.

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