

**WRITTEN FINDINGS OF THE  
WASHINGTON STATE NOXIOUS WEED CONTROL BOARD**  
(July 1995)

Scientific Name:        *Hydrilla verticillata* (L.f.) Royle

Common Name:        Hydrilla

Family:                    Hydrocharitaceae

Legal Status:            Class A

Description and Variation: Hydrilla is a submersed perennial herb that closely resembles other members of the Hydrocharitaceae, such as *Elodea canadensis* (native to Washington) and *Egeria densa* (native to South America, though established in several Washington lakes). Hydrilla can be either monoecious (both male and female flowers on the same plant) or dioecious (male and female flowers on different plants). Each type has some unique growth characteristics. It is the monoecious type that has been found in Washington State.

Hydrilla grows rooted to the bottom, submersed in either still or flowing water. The depth of growth depends on the water clarity and substrate type. The dioecious plants tend to form long stems until they near the water surface at which point the stems branch and form dense mats. Stem lengths of up to 30 feet have been recorded in clear Florida water. The monoecious plants tend to be more delicate and branch at the sediment instead. They then form many stems, which rise to the surface and fill the entire water column.

In both types, the leaves are 2 - 4 mm wide (or as small as 1 mm wide on monoecious plants) and 6 - 20 mm long. They occur in whorls of 3 - 10 leaves along the stem. They generally have sharp spines along the leaf margins, which give the leaves a toothed appearance, visible without magnification. They also often have spines along the lower midrib of the leaf, which will cause the plant to feel rough (more common in the dioecious form). The midrib of each leaf is often reddish when fresh. There are small, axillary leaf scales (squamula intravaginalis) found next to the stem and inserted at the base of the leaf, a character that distinguishes hydrilla from other family members.

Monoecious hydrilla will produce female flowers with three translucent petals (10 - 15 mm long by 4 - 8 mm wide) and three whitish sepals. They grow attached to the leaf axils and float on the water surface. Male flowers have three white to red narrow petals about 2 mm long, and three white, red, or brown sepals about 3 mm long by 2 mm wide. Male flowers are also formed in the leaf axils, but break free of the plant when mature and float to the water surface. On the water surface, the male flowers expel pollen, which is then caught by the female flowers. In North America, all dioecious plants are female.

### Economic Importance:

*Detrimental* - Hydrilla adversely impacts aquatic ecosystems by forming dense canopies that often shade out native vegetation. Extensive single species stands of hydrilla can provide poor habitat for fish and other wildlife. While dense vegetation may contain large numbers of fish, density levels attained by plant species, such as hydrilla, may support few or no harvestable-sized sport fishes. Dense mats alter water quality by raising pH, decreasing oxygen under the mats, and increasing temperature. Stagnant water created by hydrilla mats provides good breeding grounds for mosquitoes. Hydrilla interferes with recreational activities such as swimming, boating, fishing and water skiing. In addition, hydrilla has the potential to impact power generation and irrigation by clogging dam trash racks and intake pipes.

Monoecious hydrilla sends up many shoots from the sediment to the surface, thus "filling" the water column with a tremendous amount of vegetation and producing more biomass per square meter than Eurasian watermilfoil. Swimmers, especially small children, can become frightened when becoming entangled in aquatic weeds, and this can lead to drowning and near-drowning. Eurasian watermilfoil has been documented as a swimming hazard in Washington, and some deaths have been attributed to its presence in the water. If established, hydrilla, with its far denser vegetation, would be a worse hazard than Eurasian watermilfoil to the safety of Washington's swimmers.

Hydrilla also creates navigation hazards by rendering rivers and the shallow areas of lakes impassible to boating traffic. Like Eurasian watermilfoil, hydrilla forms dense tangled mats of vegetation on the water's surface. Boats can be brought to an abrupt halt when entering one of these mats without reducing speed. Passengers can be suddenly thrown backward as the boat comes to an unanticipated stop.

In areas where hydrilla, Eurasian watermilfoil, and Brazilian elodea coexist, hydrilla outcompetes these two noxious species. Hydrilla has the potential to cause greater adverse impacts to aquatic ecosystems than either Eurasian watermilfoil or Brazilian elodea, both severe problem species in Washington. In states where hydrilla has become established, millions of dollars are spent each year for management activities.

*Beneficial* - Hydrilla is eaten by waterfowl and is considered an important food source by some biologists. As with several other members of the Hydrocharitaceae, hydrilla has also been popular with the aquarium and nursery industry because it is a hardy, tolerant species.

Geographic Distribution: A cosmopolitan species, hydrilla is native to the Southern Hemisphere. In the mid- to late 1950's, a female dioecious plant was introduced into Florida, and dioecious hydrilla has since spread throughout the southeastern states including Georgia, Alabama, Virginia, and South Carolina. Hydrilla is found as far west as Texas and California. Monoecious hydrilla is found in lakes in North Carolina and the Potomac River near Washington D.C. and also has been reported in Maryland and Delaware. In Washington, the species is known only from Pipe Lake and Lucerne Lake in King County. The monoecious plants in Washington State represent the northernmost occurrence of hydrilla in the United States. Hydrilla is not known to occur in Oregon, Idaho, or British Columbia.

Habitat: Adapted to temperate and tropical climates, hydrilla grows rooted to the bottom of lakes, ponds, springs, ditches, marshes, wet ricefields, slow streams, and tidal waters, where it is submersed in either still or flowing water. The depth of growth depends on the water clarity and substrate type.

History: Hydrilla was first introduced into North America by the aquarium trade. California officials have also traced hydrilla infestations to shipments of mail order waterlilies from the New Jersey-based Lily Pons company. Once introduced and established, hydrilla is easily spread through boating and fishing activities and by waterfowl. Hydrilla tubers are readily consumed, and regurgitated tubers have been shown to be viable.

Growth and Development: Hydrilla is a perennial species that overwinters as tubers and turions (leaf axil buds). In the spring, these structures produce new growth. The plants grow very quickly to form dense mats. Hydrilla flowers in late summer and may produce fruits before dying back in the fall.

Hydrilla has several physiological and morphological adaptations that allow it to out-compete native aquatic vegetation:

- It can grow at lower light intensities than many other plants. This makes it difficult to shade out, and allows it to grow for longer periods during the day.
- It can absorb carbon from the water more efficiently than other plants, so it can continue to thrive during the summer when carbon can become limiting.
- It can also store extra phosphorus, so when lack of this nutrient limits the growth of other plants, hydrilla can use what it has stored.
- It is tolerant of a wide range of water conditions, though water quality and sediment density can influence tuber production and growth.
- It will thrive in flowing water as well as still water. Studies have shown that it actually grows faster in flowing water.
- It will tolerate salinity of up to 9 -10 parts per thousand, so it could encroach upon the outer limits of estuaries.

Reproduction: Hydrilla has many effective means of propagation. The species will spread via underground rhizomes and above ground stolons. It can sprout new plants from stem fragments containing as few as two nodes or whorls of leaves. Fragments from rhizomes and root crowns can also form new plants. The monoecious variety can set viable seed. However, the presence of seedlings appears to be rare, so seed production may be a minor means of reproduction.

The most troubling traits for aquatic plant managers is tuber and turion production. These propagules are a characteristic unique to hydrilla amongst the Hydrocharitaceae. Turions are compact buds produced in the leaf axils or, in the case of monoecious plants, on stem tips. They break off the parent plant and drift or settle to the bottom to start a new plant. Tubers are underground turions which form at the end of rhizomes. Both types of hydrilla produce tubers and turions in abundance in the fall as dormant overwintering structures. Tubers may remain dormant yet viable for several years in the sediment, especially in the case of dioecious plants.

The monoecious form will also make tubers in the spring and will produce nondormant turions throughout the growing season. It has been shown that one tuber can lead to the production of over 5,000 new tubers per square meter. The tubers and turions can withstand ice cover, drying, ingestion and regurgitation by waterfowl, and herbicides. The monoecious form apparently puts more of its energy into tuber and turion production than the dioecious form, and so has a greater potential for spread by these means.

Monoecious hydrilla has an ability to form tubers rapidly and although these tubers are generally smaller than those of dioecious hydrilla, they are produced in greater numbers and are capable of germinating at lower water temperatures. The high density of shoots produced by monoecious hydrilla may also increase its capacity for fragmentation. Efficient reproduction at low-to-moderate temperatures may provide an added competitive advantage for monoecious hydrilla in areas with short growing seasons.

Response to Herbicides: Three EPA-registered herbicides effective against hydrilla growth are permitted for use in Washington. These are fluridone (Sonar®), endothall (Aquathal®), and copper compounds. Fluridone is a systemic herbicide that has proven effective against hydrilla in Florida and other states. The drawbacks to using fluridone include its high cost, slow-action, and non-selectivity toward other macrophyte species. However, it is the herbicide of choice. Endothall, a fast-acting contact herbicide, is used when immediate control of vegetation is needed. Copper compounds are often used in conjunction with endothall applications, although copper by itself exhibits herbicidal action against hydrilla. Copper is also used for its algicidal properties when heavy periphytic growth on the hydrilla may interfere herbicide uptake. These herbicides do not affect hydrilla seeds, tubers, and turions and repeated applications are needed to control hydrilla regrowth.

Response to Mechanical Methods: Because this plant spreads readily through fragmentation, mechanical controls such as cutting and harvesting should be used only when the extent of the infestation is such that all available niches have been filled. Using mechanical controls while the plant is still invading, will tend to enhance its rate of spread.

In Florida, specially designed aquatic plant harvesters are used to cut and collect hydrilla from waterways. Hydrilla harvesting is mainly performed to open boat lanes through hydrilla beds for navigation. Because hydrilla produces more biomass per square meter than most aquatic plants, the cost of harvesting hydrilla is generally higher than for harvesting other nuisance species, such as Eurasian watermilfoil. Harvesting costs on the Potomac River were about \$1,200 per acre (costs for harvesting milfoil in Washington average \$600 to \$800 per acre).

Response to Physical Methods: Localized control (in swimming areas and around docks) can be achieved by covering the sediment with a opaque fabric which blocks light from the plants. Managers of reservoirs and some lake systems may have the ability to lower the water level as a method of managing aquatic plants. This technique is sometimes successful in areas where the hydrosol can thoroughly desiccate.

Biocontrol Potential: Worldwide surveys for natural hydrilla enemies were begun in 1981 in a cooperative study between the University of Florida, the United States Department of

Agriculture, and the U.S. Army Corps of Engineers. A number of insects were identified, quarantined and tested, and eventually released in Florida and other states. Results from these insect releases are still being evaluated. However, most of these insects were collected in tropical areas of the world, so it is doubtful that populations could establish in Washington.

The biological control with the most promise for the Pipe/Lucerne lake hydrilla infestation is the triploid grass carp. The grass carp, also known as the white amur, is an herbivorous Asian carp. Because it is an exotic species, its introduction is tightly regulated, and only the sterile triploid fish are allowed to be introduced in most states, including Washington.

Although they have access to many biocontrol agents, grass carp have been deemed the most effective biological control for hydrilla by Florida lake managers. Grass carp have definite food preferences and hydrilla is a preferred plant species.

Grass carp have proven to be an effective tool for hydrilla eradication. Hydrilla infestations reached a maximum of 79 percent on Lake Baldwin, Florida and were then eliminated by two successive grass carp stockings. California uses triploid grass carp in its Imperial Irrigation District as an eradication tool for hydrilla.

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Rationale for Listing: On June 1, 1995, hydrilla, an invasive, nonnative aquatic plant, was discovered in the 73 acre Pipe/Lucerne Lake system in the Auburn area. This is the first known occurrence of this extremely invasive freshwater plant in the Pacific Northwest.

Once established, hydrilla outcompetes native plant species and destroys freshwater recreational opportunities by forming extensive surface mats. Like other aquatic plants that form monocultures, hydrilla is a destroyer of aquatic ecosystems. Florida has spent 56 million dollars since 1984 to manage this plant and South Carolina estimates that they spend about 2.5 million each year for hydrilla control activities. We do not want Washington to be in the same situation as these states. Therefore, it is imperative to take immediate action to prevent hydrilla from being established in Washington.