

**Written findings of the
Washington State Noxious Weed Control Board
(November 2004)**

Scientific Name: *Potamogeton crispus* L.,

Common Name: curly leaf pondweed

Family: Potamogetonaceae

Legal Status: Proposed as a class C noxious Weed 2005

Description and Variation:

Curly-leaf pondweeds grows entirely underwater except for the flower stalk which rises above the water. Curly leaf pondweed has distinctly wavy-edged, crispy olive-green to reddish-brown leaves. It usually grows early in spring and dies back in summer. Similar plants include Flat-stem pondweed. The leaves of flat-stem pondweed are long and narrow with smooth edges and the sharp-edged stem is flat and about the same width as the leaves.

Leaf: Alternate, all submersed, no leaf stalks. Curly leaf: oblong, stiff, translucent leaves (4-10 cm long, 5-10 mm wide) have distinctly wavy edges with fine teeth and 3 main veins. Sheaths (stipules) up to 1 cm long are free of the leaf base and disintegrate with age. Flat-stem: smooth-edged leaves (5-20 cm long, 2-5 mm wide) have many veins. Sheaths (stipules) 2-6 cm long are free of the leaf base and become fibrous with age.

Stem: Curly leaf: branched, up to 90 cm long, somewhat flattened. Flat-stem: generally few branched, up to 2 m long, 0.7-4 mm wide, flattened, with sharp edges.

Flower: Tiny, with 4 petal-like lobes. Curly leaf: in spikes 1-3 cm long on stalks up to 7 cm long. Flat-stem: in spikes up to 3 cm long on stalks up to 10 cm long.

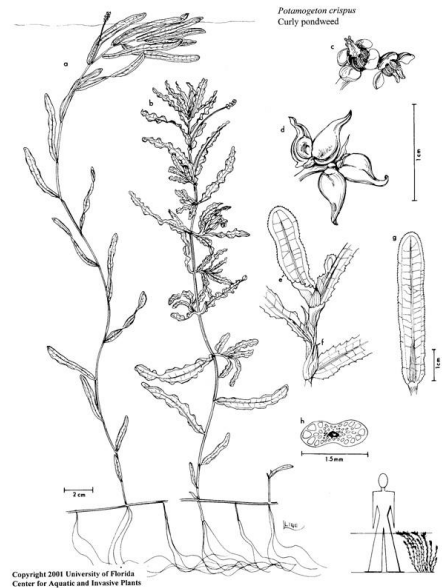
Fruit: Seed-like achene. Curly leaf: 4-6 mm long including 2-3 mm beak, back ridged. Flat-stem: approximately 5 mm long, sharp ridge on back, short beak.

Economic Importance:

Detrimental: Curly leaf pondweed (*Potamogeton crispus*) is an invasive plant that forms surface mats that interfere with aquatic recreation. Dense colonies of curly pondweed can restrict access to docks and sport fishing areas during spring and early summer months. Curly-leaf pondweed has been noted as one of the most severe nuisance aquatic plants in the Midwest only out ranked Eurasian Watermillfoil. Because populations of curly pondweed usually decline during the summer months, it does not directly compete with many of the native submersed species. Cost for control and can range in the Millions per lake.

Beneficial: none known

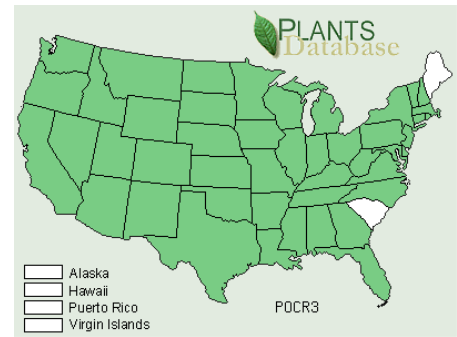
Habitat: Curly leaf: shallow to deep still or flowing water, tolerant of disturbance. Flat-stem: ponds, lakes, 1-2.5 m deep. Curly leaf: nearly worldwide. Flat-stem: widespread in temperate North America; found throughout Washington.



Geographic Distribution: Native to Eurasia, Africa, and Australia, this species has been found in most of the United States since 1950

Washington Distribution: Found in

History: Curly pondweed, *Potamogeton crispus* L., is native to Eurasia and apparently was introduced into the United States in the mid 1800's (Stuckey 1979). Prior to 1900, the distribution of *P. crispus* was the northeastern United States. By 1930 curly pondweed had spread westward to several states of the Great Lakes region. The species has since spread across much of the United States, presumably by migrating waterfowl, intentional planting for waterfowl and wildlife habitat, and possibly even as a contaminant in water used to transport fishes and fish eggs to hatcheries (Stuckey 1979).



Growth and Development: Curly pondweed perennial, rooted, submersed aquatic vascular plant that produces seed, but the importance of seed in the spread and maintenance of populations is unknown (Stuckey 1979) and is assumed to be less important than turions (Sastroutomo 1981). In most portions of its range, *Potamogeton crispus* typically reaches peak biomass in the late spring or early summer months, forms turions, then declines and "survives" the warmer months in a dormant state (i.e., as a turion) (Cypert 1967, Stuckey 1979, Sastroutomo 1981, Tobiessen and Snow 1984, Nichols and Shaw 1986). As water temperatures cool during the late summer or fall months, the turions germinate, grow through the winter months with the plants reaching peak biomass in the spring before most other submersed macrophytes begin their growth cycle. Once established, the plants regrow and form colonies from rhizomes.

Curly leaf pondweed has a unique life cycle which gives it competitive advantages over many native aquatic plants. Unlike most native plants, curly leaf pondweed may be in a photosynthetically active state even under thick ice and snow cover (Wehrmeister and Stuckey, 1978). Therefore, it is often the first plant to appear after ice out. By late spring it can form dense mats which may interfere with recreation and limit the growth of native aquatic plants (Catling and Dobson, 1985). Curly leaf plants usually die back in early summer in response to increasing water temperatures, but they first form vegetative propagules called turions (hardened stem tips). New plants sprout from turions in the fall (Catling and Dobson, 1985).

Control:

Chemical - active ingredients that have been successful in treating curly-leaf pondweed include diquat (*G*), copper with diquat (*G*), endothall (*E*), and fluridone (*E*). *E* = excellent, *G* = good

Reward is a liquid diquat formulation that has been effective on curly-leaf pondweed and is more effective if mixed with a copper compound. It is a contact herbicide. Contact herbicides act quickly and kill all plants cells that they contact.

Citrine Plus, K-Tea, Captain, Algae Pro, Clearigate are all chelated or compound copper herbicides and can be used in a mixture with Reward or Aquathol K. Other chelated or compound copper formulations are available but are not linked to this web site.

Aquathol, Aquathol K, and Aquathol Super K are dipotassium salts of endothall and comes in both liquid and granular formulations. These endothall products have been effective on curly-leaf pondweed and can be mixed with copper compounds for additional effectiveness. Contact herbicides act quickly and kill all plants cells that they contact. This herbicide has been found to be an effective and ideal method. If applied in early spring, Aquathol K will not harm the native plants since curly-leaf is the first plant to grow in the spring. It dissipates quickly leaving no residue and does not bio-accumulate in fish or hydro-soil. This treatment should kill curly-leaf, reduce or eliminate seed and turion production in the treated areas, and have less negative impact on native plants than treatments done later in summer.

Hydrothol 191 is an alkylamine salt of endothall and comes in both liquid and granular formulations. It is a contact herbicide and has been effective on curly-leaf pondweed. Contact herbicides act quickly and kill all plant cells that they contact. Hydrothol can be toxic to fish.

Sonar and **Avast** are fluridone compounds, come in both liquid and granular formulations, and have been effective on curly-leaf pondweed. These are broad spectrum, systemic herbicides. Systemic herbicides are absorbed and move within the plant to the site of action. Systemic herbicides tend to act more slowly than contact herbicides.

One danger with any chemical control method is the chance of an oxygen depletion after the treatment caused by the decomposition of the dead plant material. Oxygen depletions can kill fish in the pond. If the pond is heavily infested with weeds it may be possible (depending on the herbicide chosen) to treat the pond in sections and let each section decompose for about two weeks before treating another section. Aeration, particularly at night, for several days after treatment may help control the oxygen depletion.

One common problem in using aquatic herbicides is determining area and/or volume of the pond or area to be treated

The **mechanical and physical** control methods have been used with minimal success for the management of curly leaf pondweed. These methods include: Benthic Barrier, Drawdown, Dredging/Sediment Removal, Hand Removal, Harvesting Rotovation, Shading/Light Attenuation

Aquashade is a non-toxic dye or colorant. It prevents or reduces aquatic plant growth by limiting sunlight penetration, similar to fertilization. However, Aquashade does not enhance the natural food chain and may suppress the natural food chain of the pond.

Biological - Grass carp will seldom control aquatic vegetation the first year they are stocked. They will consume curly-leaf pondweed. Grass carp stocking rates to control curly-leaf pondweed are usually in the range of 7 to 15 per surface acre.

References:

Cypert, E. 1967. The curly-leaved pondweed problem at Reelfoot Lake. *Journal of the Tennessee Academy of Science* 42:10-11.

Nichols, S. A. and B. H. Shaw. 1986. Ecological life histories of the three aquatic nuisance plants, *Myriophyllum spicatum*, *Potamogeton crispus*, and *Elodea canadensis*. *Hydrobiologia* 131: 3-21.

Sastroutomo, S. S. 1981. Turion formation, dormancy and germination of curly pondweed, *Potamogeton crispus* L. *Aquatic Botany* 10: 161-173.

Stuckey, R. L. 1979. Distributional history of *Potamogeton crispus* (curly pondweed) in North America. *Bartonia* 46: 22-42.

Tobiessen, P. and P. D. Snow. 1984. Temperature and light effects on the growth of *Potamogeton crispus* in Collins Lake, New York State. *Canadian Journal of Botany* 62: 2822-2826.

Rationale for Listing: Dense colonies of curly pondweed can restrict access to docks and sport fishing areas during spring and early summer months.