Curlyleaf Pondweed
(Potamogeton crispus L.)

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Description

Curlyleaf pondweed (*Potamogeton crispus* L.) is a submersed herbaceous perennial plant. Originally introduced from Eurasia in the mid-nineteenth century, it was thought to be a contaminant in fish imported from that region. While native to freshwaters of Eurasia, Africa, and Australia, it is now common throughout southern Canada, the United States, Central America, and South America (Catling and Dobson 1985).

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A member of the Potamogetonaceae (pondweed) family, it is distinguished by alternate leaves that are minutely toothed, and tend to be undulating along their length. Flowers are born on a short stem that rises above the water's surface, though the rest of the plant is submersed. While seeds are produced that may be fertile, vegetative reproduction tends to be more important for both the dispersal and dormancy of this species. An individual stem may spread locally by the growth of rhizomes. Rhizomes may also play a role in "over summering," or perennation, of the plant. The most significant propagule is the "turion". A turion is a dormant shoot segment that is thickened and resistant to many environmental stressors. Turions can be made from apical buds, axillary buds, and even segments of the rhizome. Because of the variation in their origin, they may look quite different depending on the source.

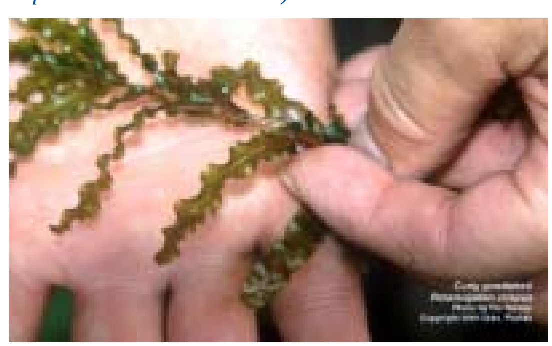
Curlyleaf pondweed has a life history that is unique among submersed aquatic plants. While most native and nonnative aquatic plants come out of dormancy in early to mid-spring and reach their maximum growth in late summer or early fall, curlyleaf pondweed has adapted to a timeframe that largely evades competition with these other plant species. The wily pondweed actually begins a new year in late summer, when its turions sprout in response to either shortening daylength or decreasing water temperature. The new growth continues until water temperatures reach their winter minima. At this point, curlyleaf pondweed stems may be a few inches to several feet tall, and they are either quiescent or slowly growing during the winter months, depending on light availability and water temperature. Once the ice is off and temperatures warm to 5 °C (40 °F), curlyleaf begins to elongate more rapidly. Curlyleaf has the highest metabolic activity in cold water of any aquatic plant species. The stems of this species reach the water's surface well in advance of any other species, and often before the other species break their spring dormancy. By late spring, a dense canopy of curlyleaf pondweed can be formed, which may restrict the growth of other species. Curlyleaf pondweed may then begin the formation of turions in early summer; followed by flowering, seed formation, and finally senescence or death of the upright stems. The turions, however, will fall to the bottom and survive until the following fall. The entire growth cycle is completed before mid-summer, often before the fourth of July. The turions may lie dormant, sprout more than one time, or sprout at other times in the year if conditions allow.

Management

The main nuisance caused by curlyleaf pondweed is the formation of dense mats. In addition, mid-summer dieback of the plant may cause rafts of dying curlyleaf to pile up on shore and/or increase phosphorus concentrations (Bolduan et al. 1994) that could lead to an increase in algae.

Most management activities are successful in removing nuisances caused by curlyleaf during the year of treatment. The two main challenges associated with management of curlyleaf pondweed are to minimize damage to native plants and to produce long-term control. Curlyleaf pondweed is a monocot, biologically similar to many valuable and common native aquatic plants. Thus, selective chemical control of curlyleaf pondweed is not generally possible (i.e., killing curlyleaf without harming adjacent native vegetation) unless it is the only aquatic plant species growing in a treated area. Curlyleaf can be managed using habitat manipulation, mechanical harvesting, and herbicides. Since curlyleaf is

Closeup of the leaf and stem of curlyleaf pondweed. (photo by Vic Ramey, University of Florida's Center for Aquatic and Invasive Plants)



generally gone by mid-July management activities should be undertaken in spring or very early summer to have the maximum benefit. Long-term management requires the reduction or elimination of turions to interrupt the life cycle of curlyleaf pondweed.

Habitat manipulations such as water level drawdown, dredging, or bottom barriers can be used to manage curlyleaf pondweed. Fall drawdown can prevent curlyleaf from growing the following summer by exposing turions to freezing temperatures and desiccation (Sastroutomo 1981). Dredging can be used to control curlyleaf by increasing water depth. In deep water rooted plants do not receive enough light to survive. Depending upon how much material is removed, dredging can prevent all rooted macrophytes from growing for many years. Bottom barriers can be used to prevent the growth of rooted aquatic macrophytes in small areas. Control of all rooted species is immediate and lasts as long as the barriers are well-maintained. Barriers are expensive to install and maintain. Most habitat manipulation projects will require special permits and coordination among lake managers and state fish and wildlife agencies.

Curlyleaf pondweed can be managed mechanically by raking, cutting, or harvesting vegetation. Raking and hand-cutting generally remove the plants at the sediment surface, while harvesting generally removes the top five feet of the plants. Mechanical methods control plants in the specific areas where they are causing a nuisance and there is immediate relief from the nuisance.

There are a small number of aquatic herbicides that can be used to control curlyleaf pondweed. Good to excellent control of curlyleaf can be obtained using formulations of diquat (e.g., Reward®) and endothall (e.g., Aquathol®) (Westerdahl and Getsinger 1988). Whole lake treatment with fluridone can also be used to control curlyleaf pondweed. Diquat and endothall (especially the former) are contact herbicides that can be used in small areas. They usually knock down curlyleaf within two weeks of treatment. Fluridone is a systemic herbicide that usually has to be applied to whole lakes or bays and requires over 30 days to knock down curlyleaf. Potential problems are failure of the herbicides to control curlyleaf, a lag time between treatment and plant knock down, regrowth of curlyleaf the following year, and the removal of beneficial native plants. Most herbicide treatments require a permit from the state natural resource agency.

Distribution of curlyleaf pondweed in the United States by year of first sighting. Data from Bolduan et al. 1994.

There is some evidence that very early spring treatment in cold water using endothall or fluridone can prevent the productions of turions. It is hypothesized that if turion production could be stopped for several years in a row, the turion "bank" in the sediments could be depleted, and the amount of curlyleaf pondweed in a lake could eventually be reduced. Currently the U.S. Army Research and Development Center (USERDC) is conducting field trials of Aquathol K® herbicide (a formulation of endothall), to evaluate both the efficacy of endothall to control curlyleaf pondweed at low temperatures, and to reduce the next summer's curlyleaf growth by reducing turion production. This is a continuation of work done by the USERDC in 1998 which showed that endothall could be effective at controlling curlyleaf in cold water, and reducing turion production (Netherland et al. 2000). SePRO, the manufacturer of Sonar™ brand fluridone herbicide has conducted experimental treatments using very early low dose (5-6 ppb) fluridone treatments. So far, they have found that curlyleaf pondweed turion production can be significantly reduced through either fall or early spring treatments. Early spring treatments, before turion formation, have significantly reduced the production of new turions (personal communication, Mike Netherland, SePRO Corp. 2001).

References

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