Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

Amended: October 2010

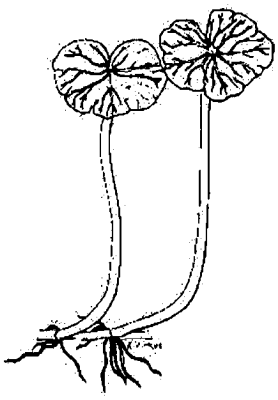
Information Sheet: Control of Floating Pennywort (*Hydrocotyle ranunculoides*)

Jonathan R. Newman, Manuel A. Duenas (2010)

Aquatic Plant Management Group

Hydrocotyle ranunculoides, the Floating Pennywort, is a native of North America but has become naturalised in Central and South America and also occurs in the Netherlands and in southern mainland Europe. It was first brought to Britain in the 1980's by the aquatic nursery trade to sell as a plant for tropical aquaria and garden ponds. The first note of concern over its potential to become a weed was published in 1936.

H. ranunculoides roots in the shallow margins of slow-flowing water bodies, particularly ditches, slow flowing dykes and lakes and forms dense interwoven mats of vegetation which can quickly cover the water surface interfering with the ecology and amenity uses of the water body. Under UK conditions mats of vegetation have been observed to grow up to 15 metres from the bank in a single season, growing at approximately 20 cm per day!



H. ranunculoides roots freely from nodes at approximately 40-60 mm intervals, its roots are profuse and hairlike. The leaves are emergent, rising on stalks from the horizontally growing stem. Both the stem and the petioles are fleshy. The leaves range from being circular to kidney shaped and are deeply lobed, they can grow up to a maximum size of 180 mm in diameter under UK conditions. Leaf matter extends up to 40 cm above the water surface and the interwoven mat of roots and stems can sink up to 50 cm into the water.

Reproduction is thought principally to be asexual and vegetative, and the plant is capable of forming extensive mats from the smallest root fragment, although introduction by seed may have occurred in at least two sites through sewage treatment works. In Australia, *H. ranunculoides* doubles its biomass in 3 days, and in the UK doubling times vary between 4 and 7 days in summer, depending on the availability of nitrate. The plant exhibits a seasonally variable growth rate in the UK, with maximum growth in the late summer when it typically forms extensive floating mats of vegetation. It over winters in the margins and on banks as a much flatter and smaller plant.

The plant is reported in about 150 sites in the south of England and south Wales, its existence a likely result of release from aquaria and garden ponds. *H. ranunculoides* has already proved to be difficult to control because of rapid growth rates combined with an ability to regrow from a single node. It is very likely to spread around UK watercourses and become a major nuisance for water resource managers in the future.

Aquatic Plant management Group
CEH Wallingford, Crowmarsh Gifford, Wallingford, Oxon, OX10 8BB
Email: jone@ceh.ac.uk Web: www.capm.org.uk

Mechanical control

H. ranunculoides can be cut with weed cutting buckets or boats. These techniques will only offer a very short-term reduction in the local extent of the plant, as it is capable of growing back rapidly from single nodes. Re-cutting will be necessary throughout the growth season. However, without thorough removal of all cut material the inevitable spread of the plant downstream will be exacerbated. Where cutting is deemed appropriate, the affected areas should be carefully fenced or, netted off, to reduce the risk of downstream infestation and to insure that all cut plant material can be removed from the water body. This is especially important in flowing situations. Mechanical removal can be practised to reduce the biomass for subsequent chemical treatment and to ease access for herbicide application, especially in dense masses.

A better option is to remove as much of the plant biomass as possible and then to go over the area hand-picking the remaining fragments. This technique has eradicated the plant for the upper reaches of the River Chelmer and the River Lee, and is the current best option for control.

Chemical control

Herbicides containing glyphosate can work well on this plant. Normal applications of 4 - 6 L product /ha in 200 L water with TopFilm at 1.2 L/ha work up to the middle of July. Applications of 4 – 6 L product / ha with Codacide Oil work form July onwards.

Decomposition of the remaining plant material is often slow, as *H. ranunculoides* typically forms extensive beds, and may take as long as six weeks in slow flowing water bodies. As *H. ranunculoides* forms such thick beds of vegetation conventional spray applications may not reach all the leaves at the first attempt. Small leaves under the main canopy may be shaded from the herbicide by those above leading to incomplete control and a source from which the plant will regrow. It is therefore essential to plan a follow-up treatment in any chemical control programme which allows spot treatment, or removal by hand, of any remaining stands of *H. ranunculoides* about 2 to 4 weeks after the first herbicide application.

Although the growth of *H. ranunculoides* is noticeable throughout the season (it may completely cover small slow flowing channels or ditches in the late summer) it does not usually reach nuisance proportions on larger water bodies until later in the summer or early autumn, with the peak growth starting in early July. However, treatment earlier in the season will reduce man-hours, equipment and chemicals needed to control the weed at a later date. Agreement must be obtained from the local Environment Agency office before application of herbicides in, on or near controlled waters.

Environmental control

There are several methods that may be used, none of which give a complete solution. Shade may be an effective method of control as the plant does not establish well in shaded conditions, and is best achieved by planting trees on the south side of the water body. This is unlikely to be practical to implement on larger water bodies. Increasing flow will restrict the growth of *H. ranunculoides* in situ but may increase the spread of the plant downstream. Increasing rooting depth to below 1 metre may reduce the ability of *H. ranunculoides* to root at the margins. This, however, is unlikely to be a feasible option. Reducing the amount of suitable rooting substrate by piling or preventing access to suitable areas by netting off sections may prove effective. All these environmental options are likely to be expensive to implement and are untested.

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Biological control

There are no known methods of biological control appropriate for use in the UK. However, A weevil. *Listronotus elongatus*, has been demonstrated to feed exclusively on *Hydrocotyle ranunculoides* in Argentina, and following collection of the weevil on this plant further work on this agent is planned in the UK The adult weevil feeds on the leaves by scraping away the leaf surface and forming discrete holes, some of which become infected by unidentified pathogens. The adult females lay eggs in the base of the petiole and the larvae develop and burrow down into the stolon. Preliminary observations indicate that larval damage is restricted to the stolon around the base of each petiole, possibly allowing other larvae to occupy neighbouring petiole / stolon sections. We have observed extensive damage caused by relatively small numbers of this weevil to the plant in Argentina. Other insects, including diptera (fly) larvae and Lepidopteran larvae (moth) also appear to feed well on this plant. Examples of all herbivorous insects have been collected for reference along with samples of pathogens for further testing.

Best practice

For effective long-term control of *H. ranunculoides* a thorough control programme mechanical removal followed up by intensive hand-picking should be used. Where physical or mechanical cutting techniques are deemed necessary the affected areas should be fenced off to prevent the downstream spread of the plant. All cut foliage should be removed from the water body. Physical control methods are likely to have little effect other than a short-term reduction in the local extent of the plant.

It is very difficult to completely control this plant and it may prove impossible to eradicate it in areas where it has formed extensive stands. Remove this plant as soon as it is observed.

Dr Jonathan R. Newman
Dr Manuel A. Duenas

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