

European water-chestnut
Trapa natans L.
Loosestrife Family (Lythraceae)

DESCRIPTION

European water chestnut is an aquatic plant, which is usually rooted in the mud; it bears a rosette of floating leaves at the tip of the submersed stem. Although it grows best in shallow, nutrient-rich lakes and rivers, it can also grow on wet, mucky substrates.

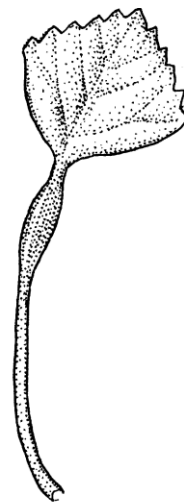
Stems - Stems are elongate, flexuous and typically about a meter long but may reach as much as 5 meters in length.

Leaves - The conspicuously toothed leaf blades are ½–1 inch long and rhombic in outline (with four sides); the spongy, inflated leaf stalks are up to 3 inches long and provide the buoyancy to keep the terminal leafy portion of the plant floating at the water surface. Green, feather-like, submersed leaves (considered by some to be modified roots) with very fine segments are present on the underwater portion of the stem.

Roots - Numerous finely branched roots develop along the lower stem and assist in anchoring the plant to the substrate.

Flowers - The inconspicuous flowers with their four white petals, each about ⅓ inch long, are borne singly on erect stalks located in the central area of the leafy rosette.

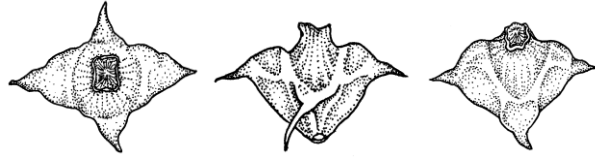
Fruit - The fruit is a black, four-horned, nut-like structure, about an inch wide, that develops under water.



REPRODUCTION AND METHODS OF DISPERSAL

In our climate European water-chestnut is an annual. Both vegetative reproduction and seed production take place. Flowers are produced singly on stalks arising from the leaf axils. Each flower is bisexual, bearing a two-chambered ovary, four stamens and four white petals. Once the ovules of the insect-pollinated flowers are fertilized, the flower stalks curve downward with the result that the fruits develop under water. The ovary and surrounding sepals mature into a nut-like, spiny fruit. Flowering begins in the northeastern United States in July and fruits ripen in about a month. The plants continue to flower until killed by frost.

One acre of water chestnut can produce enough seeds to cover 100 acres the following year. Each seed can give rise to 10–15 rosettes, and each rosette may produce as many as 20 seeds. Seeds have been known to remain viable for up to 12 years. The fruits may be dispersed when



European water-chestnut fruits

individual plants are uprooted and float downstream. Fruits fall to the bottom of the water body in the autumn and the seeds overwinter just as in terrestrial annual species. Seeds germinate in the spring, with the young root (radicle) perforating the top of the fruit.

The young plants develop narrow, opposite leaves initially. As the plant matures, the typical floating, leafy rosettes form at the end of the expanding stem. As soon as the initial shoot develops floating leaves, additional leafy offshoots are produced at a rapid rate. Some of these may become detached and develop into separate plants. It has been suggested that in warmer climates some plants may persist as short-lived perennials.

DISTRIBUTION AND HABITAT

European water chestnut is native to tropical and warm temperate regions of Eurasia. It has become naturalized in Australia and in northeastern North America. The Water-chestnut Family contains only a single genus and, depending on the view of the specialist, one, three, or as many as thirty species. This discrepancy is based in large part on the highly variable shape of the fruits. Because the fruits have been used as a source of food and for their medicinal and reputed magical properties, the plants became widely distributed throughout Europe. The plants apparently were introduced into Switzerland during the period of the lake dwellings (around 3000 BC).

In the Americas, European water-chestnut is an invasive species known for its aggressive growth habits. Plants were first introduced to North America in about 1874 and were known to be cultured in 1877 in the botanical garden of Asa Gray, the eminent Harvard University botanist. By 1879, plants were found in the Charles River in Massachusetts. Wild populations have since become established in many locations in the northeastern United States.

Presently the species is found in Maryland, Massachusetts, New York, Pennsylvania and Vermont. In 1998, it was reported for the first time in Canada, in southwestern Quebec. While not yet widespread in Pennsylvania, it is known from scattered sites in the eastern part of the state. To help control the spread of European water-chestnut, the sale of all species of *Trapa* is banned in most of the southern United States.

Plants grow in quiet streams, ponds, freshwater regions of estuaries, and on exposed mud flats. The widespread occurrence of water-chestnut in aquatic habitats of the northeastern United States is in marked contrast with its present status as a rare species in a number of European countries. It appears to be vanishing in portions of its range in such countries as Belgium, Holland, and Sweden. It is red listed in Baden-Württemberg (southern

Germany) and is listed on [Appendix I of the Bern Convention](#) (Council of Europe, Convention on the Conservation of European Wildlife and Natural Habitats) as a strictly protected species.

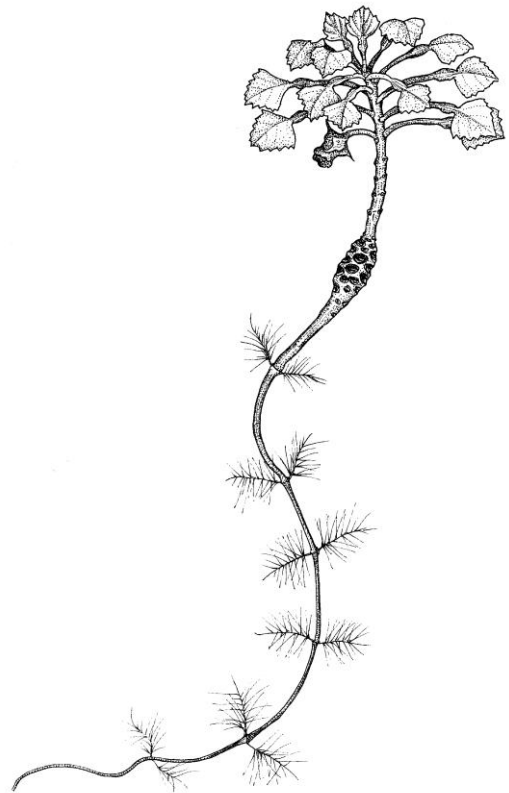
EFFECTS OF INVASION

The plants have become an aquatic nuisance species in North America because of their ability to reproduce rapidly and form extensive floating mats. Due to its dense growth, the species impedes navigation and its low food value for wildlife potentially can have a substantial impact on the use of an area by waterfowl and other native species. The dense surface mats likely also inhibit the growth of other aquatic plant species. Decomposition of the abundant detritus produced in the fall of each year as the plants senesce, could contribute to lower oxygen levels in shallow waters and thus impact other aquatic organisms. With four, hard, half-inch spines that are sharp enough to penetrate shoe leather and large enough to keep people off beaches, the seeds are a major hazard to water-based recreation.

CONTROL

Mechanical - Control of this species has consisted primarily of mechanical harvesting of the floating mats by means of weed harvesters used to clear waterways. Repetitive harvesting over a number of years may be effective in eradicating this aquatic weed in small enclosed bodies of water. However, such mechanical harvesting likely will only serve to open navigation passageways in waterways on an interim basis and will not provide a long-term solution in heavily infested areas of large lakes or streams. Smaller populations may be controlled by persistent hand harvesting over a period of several years.

Biological - Attempts have been made to find suitable biocontrol insects through searches conducted in 1992 and 1993 in China, Japan, South Korea, and the Russian Far East but no appropriate candidates were found. A similar attempt was made in 1995 in Europe, including France, Germany, Italy, and Poland without success. Potential natural enemies have been reported from warmer climates such as in India. Such species may not be suitable for the cooler regions of the northeastern United States but may become suitable subjects for study as biocontrol agents if European water-chestnut extends its range further southward into warmer areas of the United States.



REFERENCES

Block, Timothy A. and Ann Fowler Rhoads. 2011. *Aquatic Plants of Pennsylvania, A Complete Reference Guide*. University of Pennsylvania Press, Philadelphia, PA 19118.

Heywood, V. H. 1978. *Flowering Plants of the World*. Prentice Hall, Inc., Englewood Cliffs, NJ

Rhoads, Ann Fowler and Timothy A. Block. 2007. *The Plants of Pennsylvania: An Illustrated Manual*, 2nd edition. University of Pennsylvania Press, Philadelphia, PA.

Rhoads, Ann Fowler and William McKinley Klein. 1993. *The Vascular Flora of Pennsylvania: Annotated Checklist and Atlas*. American Philosophical Society, Philadelphia, PA.

Internet resources - <http://www.upenn.edu/paflora>, <http://www.invasivespecies.gov>



Invasive species fact sheet prepared by:

Ann F. Rhoads and Timothy A. Block
Morris Arboretum of the University of Pennsylvania
100 Northwestern Ave., Philadelphia, PA 19118
Updated November 2011