

Invader of the Month – Garlic Mustard - *Alliaria petiolata* (Bieb.) Cavara & Grande

Garlic Mustard, native to Europe, is variable in its size and growth habit, and in its success in different site conditions. Genetic analysis suggests that North American populations are the result of multiple introductions. In North America, it is invasive in many habitats including roadsides, gardens, and most importantly, native deciduous upland or streamside forests. It was first reported on Long Island in 1868. Recognized as invasive in CT in 1997, it has been listed as “widespread and invasive” since 2000. Preserve managers now have Garlic Mustard on their radar screens. Some people noticing it for the first time say, "What is this plant? It came up this year out of nowhere!"

In its native Europe, Garlic Mustard grows as an annual, perennial, or biennial. In the USA, Garlic Mustard typically is a biennial. In spring of its second year, it shoots up a flowering stalk 1 to 3½ or more feet tall (taller heights in sunnier sites). By late spring/early summer, the stalk has many small, white flowers (roughly ¼ inch across), each with 4 evenly spaced petals. Prior to the flowering of second year plants, new seedlings germinate in late-winter or very early spring.

The first year's growth of Garlic Mustard is variable. Scattered plants are easily overlooked when they have just 3 or 4 leaves growing on long, curving stems that radiate out, spoke-like, from the rootstalk. These basal leaves are rounded or kidney-shaped, with scalloped margins and typically are 2 to 3 inches (or more) across. Mats of densely crowded seedlings have much smaller leaves. Most first year seedlings do not survive summer dryness. Surviving plants may produce additional basal leaves in late fall. First year plants turn dark-green or purplish in fall and over winter under snow. New basal leaves (often less than 1½ inches wide) may grow during snow-free periods if temperatures are above freezing.

The second year's rapid growth begins in March or April. Prior to flower stalk production, some plants have produced many additional basal leaves while others have produced just a few more. Typically, there is a single tall flower stalk. (Some plants have branched stalks or multiple tall stalks, while others produce flowers on stalks only 2 inches tall that may appear at times other than spring.) On tall flower stalks, the leaves alternate up the stalk, the first leaf being some 2½ inches wide while the next ones are smaller and increasingly triangular in shape with increased distance from the ground. The leaves on the flower stalk tend to have large pointed teeth rather than scalloped margins. The heart-shaped leaf bases never clasp around the flowering stalk.

Garlic Mustard fruits (long, narrow seed “pods”) grow upward and outward from short, thickened stalks. The fruits elongate to about 1 to 2½ inches long and are 4-angled, slightly puffy, but less than 1/8 inch wide. Once elongated, early fruits attached lower on the main stalk will extend higher than the small flowers still blooming at the top of the stalk. The fruits are found in June. The plants soon die, but dried up, light tan, seed pod-bearing stalks remain standing into Fall.

Garlic Mustard has a rank aroma (less noticeable on older foliage). When new foliage is crushed between thumb and fingers, the aroma lingers as a garlic-like odor on the skin. The scent, not quite that of garlic bulbs, is more similar to garlic than it is to radish or other mustard family

plants. When the rank odor is not evident, the combination of a mustard-like taproot (with a right-angled kink) and rounded or kidney-shaped basal leaves distinguishes first year Garlic Mustard plants from certain Violets or other herbaceous plants with round or kidney-shaped leaves. If a plant with rounded basal leaves has fleshy rhizomes or spreading stolons in its rooting area rather than a kinked taproot, it is NOT Garlic Mustard.

Garlic Mustard out-competes native plants by several mechanisms. Researchers point to a correlation between the presence of Garlic Mustard and the large, non-native earthworms that rapidly digest forest floor leaf litter, exposing bare soil. At garden/forest interfaces, Kathleen Nelson reports that keeping a leaf litter cover discourages Garlic Mustard from establishing. Once established, Garlic mustard roots are thought to release chemical compounds that harm both nearby plants and the mycorrhizal fungi that help native plant roots take up water and nutrients. Garlic Mustard's early-spring growth allows it to dominate forest sites that otherwise would support native spring wildflowers; and early tall growth, chemical interference, and shade tolerance allow it to out-compete new tree seedlings in the forest understory. Deer avoid eating Garlic Mustard, thereby putting more browsing pressure on the remaining native plants. With the continued presence of deer, leaf litter depletion by exotic earthworms, and the loss of native seeds in areas dominated by Garlic Mustard, site restoration will require active re-planting of natives and management of other factors in addition to Garlic Mustard removal.

Garlic Mustard reproduces and spreads only by seed (up to 7,900 seeds per plant); control of its prolific seed production is key. The best way to control Garlic Mustard is to look for it every year even if you have never seen it on your property. If found, deal with very small populations immediately and larger ones before they flower and build up a large seedbank. Garlic Mustard seeds may remain viable in the soil for up to 5 (or more?) years. Because of heavy seed production and long lived seeds, once Garlic Mustard is established at a site, multiple years of intensive control may be required before the infestation even starts to get reduced. Follow-up monitoring and additional control are “must do” activities.

Hand-pulling is an effective control method for small infestations. Plants with flowering stalks typically are easily pulled. However, the risk of waiting until the plants flower is that some plants may produce seeds before flowering in the area is noticed. Further, if the root is not completely removed, the remaining root often will send up a second flowering stalk. First year plants are frequently more resistant to pulling. In the fall after frost but before the ground freezes is a good time to pull because the roots are likely to be less tightly held and many individuals have already been killed over summer.

Pulled-out, second-year stalks may have enough food reserves to allow young seed pods to grow and ripen. Therefore, all pulled second-year stems should be removed from the site (or at least deposited in one place where seedlings can be located and pulled the following years). Some people recommend placing the pulled material into plastic bags for "solarizing". In CT, this method may not create enough sustained heat to kill all the seeds. Removal of pulled stems is imperative in floodplains and other areas where flowing water or snowmelt waters may transport seeds to new sites. Large infestations of Garlic Mustard may be sprayed with glyphosate. If foliar spraying is done in very early spring or late fall, killing of dormant, deciduous, native plants will be avoided. The effects of fall spraying on first year seedlings may

not be evident until spring when the plants fail to send up a flower stalks. Federal law requires following all recommendations for safety and use of a herbicide as described on its container label.

Other potential methods for Garlic Mustard control include biological control (currently not available) and the use of a motorized string trimmer (aka "weed eater") to cut off flowering Garlic Mustard stalks near the ground. Note that cutting may fling seeds; and cut flower stalks still should be gathered. Cutting also runs the risk that a second flowering stalk will arise from buds at the stem base or root crown.

The Norwalk River Watershed Association (NRWA) sponsors annual Garlic Mustard control workdays. Information on their April 29, 2006 workday in Ridgefield, CT will be available at 1-877-679-2463 ext 2 (NRWA toll free number).

Photos and text by Charlotte Pyle, USDA Natural Resources Conservation Service (charlotte.pyle@ct.usda.gov).

References for identification, control, and ecology are:

<http://www.ct.nrcs.usda.gov/invas-factsheets.html>

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http://www.hort.uconn.edu/cipwg/art_pubs/GUIDE/guideframe.htm

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Frontiers in Ecology and the Environment 2004; 2(8):427-435 [earthworms]

Journal of Ecology 2000; 88:447-463 [Garlic Mustard]

Newsletter of the CT Botanical Soc. 25(2), Summer 1997: 8-11. [plant list]



The whole plant



Flowers (their real size is roughly 1/4 inch across)



Top of flowering stalk with green fruits and a few wilted white flowers at the top of the stalk



Dead Garlic Mustard plants with fruits extending outward and upward from tall flower stalk



Rounded leaves



Kinked Garlic Mustard root



Violet root



Glechoma hederacea with rounded leaves and creeping rootstock



Thick infestation of Garlic Mustard