



Garlic Mustard

Alliaria petiolata [Bieb] Cavara & Grande
Mustard family (Brassicaceae)

NATIVE RANGE

Europe

DESCRIPTION

Garlic mustard is a cool season biennial herb with stalked, triangular to heart-shaped, coarsely toothed leaves that give off an odor of garlic when crushed. First-year plants appear as a rosette of green leaves close to the ground. Rosettes remain green through the winter and develop into mature flowering plants the following spring. Flowering plants of garlic mustard reach from 2 to 3½ feet in height and produce buttonlike clusters of small white flowers, each with four petals in the shape of a cross.

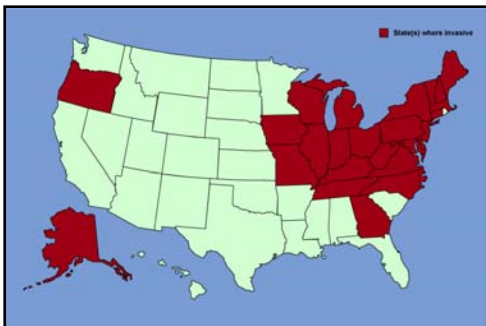
Recognition of garlic mustard is critical. Several white-flowered native plants, including toothworts (*Dentaria* spp.), sweet cicely (*Osmorhiza claytonii*), and early saxifrage (*Saxifraga virginica*), occur alongside garlic mustard and may be mistaken for it.

Beginning in May (in the mid-Atlantic Coast Plain region), seeds are produced in erect, slender pods and become shiny black when mature. By late June, when most garlic mustard plants have died, they can be recognized only by the erect stalks of dry, pale brown seedpods that remain, and may hold viable seed, through the summer.

ECOLOGICAL THREAT

Garlic mustard poses a severe threat to native plants and animals in forest communities in much of the eastern and midwestern U.S. Many native wildflowers that complete their life cycles in the springtime (e.g., spring beauty, wild ginger, bloodroot, Dutchman's breeches, hepatica, toothworts, and trilliums) occur in the same habitat as garlic mustard. Once introduced to an area, garlic mustard outcompetes native plants by aggressively monopolizing light, moisture, nutrients, soil and space. Wildlife species that depend on these early plants for their foliage, pollen, nectar, fruits, seeds and roots, are deprived of these essential food sources when garlic mustard replaces them. Humans are also deprived of the vibrant display of beautiful spring wildflowers.

Garlic mustard also poses a threat to one of our rare native insects, the West Virginia white butterfly (*Pieris virginiensis*). Several species of spring wildflowers known as "toothworts" (*Dentaria* spp.), also in the mustard family, are the primary food source for the caterpillar stage of this butterfly. Invasions of garlic mustard are causing local extirpations of the toothworts, and chemicals in garlic mustard appear to be toxic to the eggs of the butterfly, as evidenced by their failure to hatch when laid on garlic mustard plants.



DISTRIBUTION IN THE UNITED STATES

Garlic mustard ranges from eastern Canada, south to Virginia and as far west as Kansas and Nebraska.

HABITAT IN THE UNITED STATES

Garlic mustard frequently occurs in moist, shaded soil of river floodplains, forests, roadsides, edges of woods and trails edges and forest openings. Disturbed areas are most susceptible to rapid invasion and dominance. Though invasive under a wide range of light and soil conditions, garlic mustard is associated with calcareous soils and does not tolerate high acidity. Growing

season inundation may limit invasion of garlic mustard to some extent.

BACKGROUND

Garlic mustard was first recorded in the United States about 1868, from Long Island, New York. It was likely introduced by settlers for food or medicinal purposes.

BIOLOGY & SPREAD

After spending the first half of its two-year life cycle as a rosette of leaves, garlic mustard plants develop rapidly the following spring into mature plants that flower, produce seed and die by late June. In the mid-Atlantic Coastal Plain region, seeds are produced in erect, slender, four-sided pods, called siliques, beginning in May. Siliques become tan and papery as they mature and contain shiny black seeds in a row. By late June, most of the leaves have faded away and garlic mustard plants can be recognized only by the dead and dying stalks of dry, pale brown seedpods that may remain and hold viable seed throughout the summer.

A single plant can produce thousands of seeds, which scatter as much as several meters from the parent plant. Depending upon conditions, garlic mustard flowers either self-fertilize or are cross-pollinated by a variety of insects. Self-fertilized seed is genetically identical to the parent plant, enhancing its ability to colonize an area. Although water may transport seeds of garlic mustard, they do not float well and are probably not carried far by wind. Long distance dispersal is most likely aided by human activities and wildlife. Additionally, because white-tailed deer prefer native plants to garlic mustard, large deer populations may help to expand it by removing competing native plants and exposing the soil and seedbed through trampling.



MANAGEMENT OPTIONS

Because the seeds of garlic can remain viable in the soil for five years or more, effective management requires a long term commitment. The goal is to prevent seed production until the stored seed is exhausted. Hand removal of plants is possible for light infestations and when desirable native species co-occur. Care must be taken to remove the plant with its entire root system because new plants can sprout from root fragments. This is best achieved when the soil is moist, by grasping low and firmly on the plant and tugging gently until the main root loosens from the soil and the entire plant pulls out. Pulled plants should be removed from site if at all possible, especially if flowers are present.

Mechanical

For larger infestations of garlic mustard, or when hand-pulling is not practical, flowering stems can be cut at ground level or within several inches of the ground, to prevent seed production. If stems are cut too high, the plant may produce additional flowers at leaf axils. Once seedpods are present, but before the seeds have matured or scattered, the stalks can be clipped, bagged and removed from the site to help prevent continued buildup of seed stores. This can be done through much of the summer.

Chemical

For very heavy infestations, where the risk to desirable plant species is minimal, application of the systemic herbicide glyphosate (e.g., Roundup®) is also effective. Herbicide may be applied at any time of year, including winter (to kill overwintering rosettes), as long as the temperature is above 50 degrees F and rain is not expected for about 8 hours. Extreme care must be taken not to get glyphosate on desirable plants as the product is non-selective and will kill almost any plant it contacts. Spray shields may be used to better direct herbicide and limit non-intentional drift.

Fire

Fire has been used to control garlic mustard in some large natural settings but, because burning opens the understory, it can encourage germination of stored seeds and promote growth of emerging garlic mustard seedlings. For this reason, burns must be conducted for three to five consecutive years. Regardless of the control method employed, annual monitoring is necessary for a period of at least five years to ensure that seed stores of garlic mustard have been exhausted.

Biological

Researchers are investigating potential biological control agents for garlic mustard which may greatly improve the control of this insidious weed.

USE PESTICIDES WISELY: Always read the entire pesticide label carefully, follow all mixing and application instructions and wear all recommended personal protective gear and clothing. Contact your state department of agriculture for any additional pesticide use requirements, restrictions or recommendations.

NOTICE: mention of pesticide products on this page does not constitute endorsement of any material.

CONTACTS

For more information on the management of garlic mustard, please contact:

- Cornell University, Biological Control of Weeds--Garlic Mustard; <http://www.invasiveplants.net>
- Tennessee Exotic Pest Plant Council; <http://www.tneppc.org/>
- Victoria Nuzzo, Cornell University, Ithaca, NY (vnuzzo@earthlink.net)
- Virginia Natural Heritage Program Fact Sheet--Garlic Mustard; <http://www.state.va.us/~dcr/dnh/invallia.htm>

OTHER LINKS

- <http://www.invasive.org/search/action.cfm?q=Alliaria%20petiolata>
- <http://nbii-nin.ciesin.columbia.edu/ipane/icat/browse.do?specieId=15>

AUTHORS

Pamela Rowe, Montgomery County Department of Environmental Protection, Rockville, MD
Jil M. Swearingen, National Park Service, Washington, DC

PHOTOGRAPHS

Olivia Kwong, Plant Conservation Alliance, Washington, DC
John M. Randall, The Nature Conservancy, Davis, CA
Olivia Kwong, Plant Conservation Alliance, Washington, DC

REFERENCES

- Abugatta, Alonso. 1996. Progress made in educating about problems with invasive plants. Virginia Native Plant Society Newsletter, Vol. 15, No. 3, (May) p. 5.
- Byers, D.L. 1987. The effect of habitat variation in *Alliaria petiolata* on life history characteristics. American Journal of Botany 74:647.
- Nuzzo, V.A. 1991. Experimental Control of garlic mustard in Northern Illinois using fire, herbicide, and cutting. Natural Areas Journal 11(3):158-167.
- Nuzzo, V.A. 1993. Distribution and spread of the invasive biennial garlic mustard (*Alliaria petiolata*) in North America, pp. 137-146. In B.N. McKnight (ed.), Biological Pollution. Indiana Acad. Sci. Indianapolis, Indiana, 261 pp.
- Nuzzo, V.A. 1996. Impact of dormant season herbicide treatment on the alien herb garlic mustard (*Alliaria petiolata*) [Bieb] Cavara & Grande. Transactions of the Illinois State Academy of Science, vol 89, pp. 25-36.
- Swearingen, J. 2009. WeedUS Database of Plants Invading Natural Areas in the United States: Garlic Mustard (*Alliaria petiolata*). <http://www.invasive.org/weedus/subject.html?sub=3005>.

Tennessee Exotic Pest Plant Council. 1997. Tennessee Exotic Plant Management Manual, pp. 56-59.

The Nature Conservancy. Garlic Mustard: Element Stewardship Abstract. In: Wildland Weeds Management & Research Program, Weeds on the Web.

USDA, NRCS. 2009. The PLANTS Database (<http://plants.usda.gov>). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.