



Japanese barberry

Berberis thunbergii

Japanese barberry is native to Japan, and was introduced to the United States in the late 1800s as an ornamental plant. It is used widely as landscape material, due in part to its resistance to deer browsing. Where deer numbers are high, palatable native species are replaced by barberry. It thrives both in full sun and deep shade. Like many non-native shrubs, it leafs out early, retains its leaves late into fall and forms dense thickets, shading out native plants.

Japanese barberry benefits from high nitrogen availability. It appears to have a complex relationship with non-native earthworms, which are associated with increased soil nitrification and break down litter rapidly. On sites where barberry is controlled, earthworm densities are reduced.

Recently, barberry has been implicated in the spread of Lyme disease. Researchers have noted higher densities of adult deer ticks and white-footed deer mice under barberry than under native shrubs. Deer mice, the larval host, have higher levels of larval tick infestation and more of the adult ticks are infected with Lyme disease. When barberry is controlled, fewer mice and ticks are present and infection rates drop.

Identification

Habit:

Japanese barberry is a spiny, deciduous shrub, with arching branches. Typically, it is about 0.6 - 0.9m (2-3 ft) tall, although it can reach 1.8m (6 ft) in height.

Leaves:

Japanese barberry has small oval to spoon shaped leaves with smooth margins. They are arranged in clusters along the stem and turn red in fall. Cultivars are available in chartreuse and burgundy. While many cultivars do not produce flowers or fruit, burgundy leaved plants have begun to appear in woodlands.



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Bark/Stems:



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Barberry's arching stems are deeply grooved, with single spines at each node. Its twigs and young stems turn reddish brown in winter and the older stems are gray. The inner bark and wood are yellow.



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Flowers:



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Japanese barberry has tiny, pale yellow, dangling flowers with six petal-like sepals and 6 smaller petals. They hang singly or in clusters of 2 to 4 blossoms from the nodes. They are insect pollinated and bloom in April and May.

Fruits/Seeds:

Barberry fruits are small, bright red, egg-shaped berries with dry flesh that are about 1 cm (0.4 in) long. They ripen in midsummer but remain on stems into winter. Fruits are dispersed by deer and birds.



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Habitat:

Japanese barberry tolerates a wide range of soil and moisture conditions and is extremely shade tolerant. It is found along woodland edges, roadsides, stream banks, old fields and forests. It may be more common and abundant in forests that were pastured or farmed in the past.

Similar species

Common barberry

The non-native invasive common barberry (*Berberis vulgaris*) has finely toothed leaves and may reach 3 m (10 ft) in height. It was eradicated from large parts of its range including Michigan, as it is a host to black stem grain rust.



American barberry

American barberry (*B. canadensis*), has toothed leaves and usually three pronged spines. Its flowers hang in clusters suspended from a central stem, rather than attaching directly to the twig, as is the case in Japanese barberry. It is native south of Michigan.

Reproduction/Dispersal

Japanese barberry reproduces by seed, by clonal shoots below ground and by the tips of its branches, which root freely where they touch the ground. The shrub will also resprout vigorously when damaged by cutting or fire. Fruit production is highest on sites in full sun, but plants in shade will also produce fruit.

Seeds benefit from a period of cold or alternating low temperatures but some will germinate without it. Seeds that have begun to germinate are vulnerable to freezing temperatures, however. Germination rates fall off dramatically after one year, suggesting that barberry does not develop a large or persistent seedbank.

Most fruits fall directly below the shrub but some individuals have been noted in undisturbed forests several kilometers from any seed source, demonstrating that longer range dispersal is possible. Ground dwelling birds may be more significant dispersal agents than songbirds. The fruit persists on the branches until late in winter and appears to be eaten when preferred foods are no longer available. Historically, Japanese barberry established readily in pastures, as it was avoided by livestock. It then spread into nearby woodlands.

Seedlings may grow up to 1.2 m (4 ft) in a single season when light, moisture and nutrients are abundant. They may only produce a single stem for several years or send up multiple shoots, depending on moisture and light availability. Seedling mortality is highest during summer months

Since old stems die off and are replaced periodically, it is difficult to determine the age of individual plants. Mortality appears to be highest for plants with only one or two stems and/or stems that are less than 50 cm (20 in) long. Barberry seedling survival and plant growth vary with light availability. Biomass per unit area is positively correlated with both light and moisture availability.

Planning a control program

Resources for invasive species control invariably fall short of the actual need, so it is important to prioritize sites for treatment and plan carefully. Assessing the scope of the problem is a critical first step:

- Map known Japanese barberry populations;
- Does it occur in high quality habitat, important recreational, hunting or fishing lands? Other high value sites?
- Are other woody invasives present that should be treated simultaneously?
- Is there a pool of volunteers available to assist with control? Or will efforts rely on paid staff or contractors?

Given this information, develop a strategy for control:

1. Prioritize high value sites where success can be achieved for treatment.
2. Select appropriate control methods, considering site conditions, available resources and any other woody invasives that might be present. While barberry is easy to kill, if other more challenging species are present, it may be best to select methods that will control them also.
3. If using herbicide, be sure to read the product label before finalizing plans. Is there potential for harm to non-target species? Have you made adequate provisions to minimize damage?
4. Do these control methods require any permits (i.e. herbicide application in wetlands, prescribed burning)?
5. Prevent further dispersal; focus on mature plants, particularly those in full sun with abundant fruit.
6. Eradicate smaller satellite populations nearby that may provide a source of seed for re-invasion.
7. Treat larger core infestations of lower value as resources permit.
8. Monitor to ensure desired results are being achieved; adapt management to improve success.

Best survey period

Like many invasive shrubs, Japanese barberry typically leafs out early in spring and retains its leaves late into fall, making it most visible at these times. It is also conspicuous when in fruit. Its low, sprawling profile and narrow sharp spines are distinctive and make it readily identifiable in any season.

Documenting occurrences

In order to track the spread of an invasive species on a landscape scale, it is important to report populations where they occur. The Midwest Invasive Species Information Network (MISIN) has an easy-to-use interactive online mapping system. It accepts reports of invasive species' locations from

users who have completed a simple, online training module for the species being reported. It also offers the potential for batch uploading of occurrence data for any invasive species. Herbaria also provide a valuable and authoritative record of plant distribution. The University of Michigan Herbarium's database can be searched online for county records of occurrence, for example. When Japanese barberry is first encountered in a county where it had not been known previously, specimens should be submitted to the Herbarium to document its presence. Check the "Online Resources" section for links to both of these resources.

Control

A primary goal in controlling this species is to prevent seed production and dispersal. In general, plants in full sun produce more seed than those in shade and should be prioritized for control. Control efforts in spring and fall while desirable native species are dormant may minimize harmful impacts. A variety of techniques including both mechanical and chemical controls may be most effective and should be tailored to the specific conditions on the site. It is critical to monitor the site to ensure that cut stumps or treated plants do not resprout and the seedbank is exhausted. Where abundant seed sources are present nearby, monitoring may be required indefinitely.

Mechanical control

Mechanical controls such as pulling and digging may be adequate to control or eradicate Japanese barberry in small infestations, or on well shaded sites where plants are less robust, as their root systems are shallow. Mechanical control methods are particularly useful where volunteers are available. In larger, established infestations, mechanical controls may be used effectively along with chemical control methods.

Pulling/Digging

Because Japanese barberry has shallow roots, pulling seedlings and small plants provides effective control of small infestations. Gloves are needed for protection from the plant's sharp spines.

It is easiest to pull when the soil is moist; remove the root crown and as much of the roots as possible. If portions of the root crown are left, they may be able to resprout. Pull steadily and slowly to minimize soil disturbance and tamp down the soil afterwards. Tools such as the Weed Wrench® or Root Talon® provide additional leverage, facilitating the removal of somewhat larger plants.

Larger plants can also be removed with a spade. The disturbed soil should be tamped down thoroughly and covered with leaves if they are available.

Cutting/Mowing

Repeated cutting and mowing alone may limit barberry's spread but will not control it as it resprouts from the root

crown. Its spiny stems and arching branches make cutting difficult. Mowing can be used effectively as the first step of a two part control effort when resprouts are treated with herbicide or burned with a propane torch later in the season.

Chemical control

While mechanical control is a viable option for some Japanese barberry infestations, herbicides offer additional advantages, particularly for large robust populations where little native vegetation is present. Factors that should be considered when selecting an herbicide for use on a particular site include proximity to water or wetlands, presence or absence of desirable native vegetation, potential for erosion and the effectiveness of the herbicide under consideration. Because barberry remains green much later than many native species, fall treatment may minimize damage to desirable plants.

General considerations

Anyone applying herbicides as part of their employment must become a certified pesticide applicator. In addition, certification is required for the use of some herbicides under any circumstances. The certification process is administered by the Michigan Department of Agriculture and Rural Development and a link to their website is included in the "Online Resources" section.

A permit from the Michigan Department of Environmental Quality is usually required to apply herbicide where standing water is present—in wetlands, along streams, rivers or lakes, or over open water. A permit is also required for herbicide use below the ordinary high water mark along the Great Lakes or Lake St. Clair shoreline, whether or not standing water is present. A link to their website is included in the "Online Resources" section.

A number of adjuvants or additives may be used with herbicides to improve their performance including mixing agents, surfactants, penetrating oils and dyes. Some are included in premixed products while others must be added. Adjuvants do not work with all products; consult the product label to determine which adjuvants may be used with a specific herbicide formulation.

Dyes are useful in keeping track of which plants have been treated and making spills on clothing or equipment apparent. Some premixed herbicide include them or they can be added to others. Clothing dyes such as Rit® can be added to water soluble herbicides, while other products require oil-based dyes. Consult the product label for specific instructions.

Crop Data Management Systems, Inc. (CDMS) maintains a database of agro-chemicals that includes herbicide labels for specific products. Herbicide labels contain information



on application methods and rates, specific weather conditions, equipment types, nozzles etc. to provide the desired coverage and minimize the potential for volatilization or drift. They also contain critical information about the potential for damage to valuable non-target species. A link to the CDMS website is included in the "Online Resources" section.

Read the entire pesticide label before use. Follow all directions on the label.

Herbicide specifics

Glyphosate (e.g., Roundup®, Rodeo®, Accord®) can provide effective control of barberry both as a foliar spray and for cut surface treatments. It is most effective for cut surface treatment while plants are fully leafed and actively growing.

It should not be used in spring, while leaves are emerging and sap is flowing upward as it is not effective at this time. Glyphosate is not selective and will kill desirable non-target species, in some cases leading to increased erosion on site.

Triclopyr provides effective control of barberry but does not kill grasses or some conifers. It is available in both amine (e.g., Garlon 3A®) and ester (e.g., Garlon 4 Ultra®) formulations. The amine formulation can be safely used in wetlands.

Triclopyr can be used as a foliar spray once barberry is fully leafed out in spring until just before it changes color in fall. The ester formulation should be used with a vegetable oil based multi-purpose adjuvant (e.g. SprayTech® Oil) and the amine formulation should be used with a wetland-approved non-ionic surfactant (e.g., Cygnet Plus®).

Triclopyr can also be used in conjunction with cut-stump treatment. Treatments may be applied throughout the year including when snow is present, however control may be reduced in early spring when the sap is beginning to flow or during periods of drought in summer.

Ester formulations are particularly effective for root or stem-sprouting species such as barberry because the triclopyr persists in the plant until it dies. The ester formulation should be used with a penetrating oil (e.g., AX-IT®), which improves effectiveness and increases the amount of time after cutting in which treatment can occur.

In non-target plants, triclopyr residues in the soils can damage non-target species via root uptake. Use caution in high-quality forests.

In wetlands or other sensitive areas, the amine formulation may be used for cut-surface treatments but must be painted onto the cut surface immediately.

Foliar application

Foliar application of herbicide can be useful on sites with dense barberry thickets and few desirable natives. Herbicide should be applied after periods of heavy sap flow in spring to actively growing plants, although during periods of drought or other stress, it may not be effective. It can be

applied to barberry foliage with squirt bottles, backpack sprayers or boom-mounted sprayers.

The product label for the specific herbicide being used provides essential information on coverage; how much of the foliage should be treated and how wet it should be. Herbicide labels also contain information on specific weather conditions, application modes, equipment types, nozzles etc. to provide the desired coverage and minimize the potential for volatilization or drift.

The herbicide applicator is responsible for managing drift and damage to non-target vegetation. Wind speeds between 3 and 10 miles per hour are best for foliar herbicide spraying. At higher wind speeds, herbicide may be blown onto adjacent vegetation or water bodies.

At lower wind speeds, temperature inversions can occur, restricting vertical air movement. Under these conditions, small suspended droplets of herbicide can persist in a concentrated cloud and be blown off-target by variable gusts of wind. Ground fog indicates the presence of a temperature inversion, but if no fog is present, smoke movement on the ground can also reveal inversions. Smoke that layers and remains trapped in a cloud at a low level indicates an inversion, while smoke that rises and dissipates indicates good air mixing.

In hot, dry weather, herbicide can evaporate rapidly. Setting equipment to produce large droplets can help compensate for this. In general, follow all directions on the label of the specific herbicide being used, in order to prevent damage to non-target vegetation or water bodies.

Cut-stump

Cut-stump treatment may be used in any season except during periods of heavy sap flow in spring, when sap is flowing upwards. Some chemicals are less effective at lower temperatures or when plants are dormant. Refer to the herbicide label for specific details. Product labels list what adjuvants may be used to increase effectiveness of the herbicide; penetrating oils only work with ester formulations, for example. Similarly, dyes, which are useful in keeping track of which stems have been treated, may be water or oil-based and should be selected to work with a specific herbicide formulation.

Cut-stump treatment is useful for species like barberry that normally resprout after cutting. Gloves are needed for protection from the plant's spiny stems. After the stems have been cut, they are painted with concentrated herbicide, using a squirt bottle or wicking applicator.

Treated plants should be monitored for at least a year as they may still resprout. New stems may be treated with a foliar spray, or cut and retreated.

Prescribed burning

In fire-adapted communities, prescribed burning may enhance control of Japanese barberry, but should always be considered as part of an integrated management plan for the site.

General considerations

A permit is required before implementing a prescribed burn. The Michigan Department of Natural Resources (DNR) is responsible for issuing burn permits in the Upper Peninsula and Northern Lower Peninsula unless a municipality wishes to do so. Municipalities located in the Southern Lower Peninsula issue burn permits under authority of the state law. A link to the DNR local fire contacts web page is included in the “Online Resources” section. In the Southern Lower Peninsula, contact the local Fire Marshall for permits and more information. Some municipalities require insurance coverage before a permit is issued, to cover the cost of damages if the fire should escape.

Before initiating a program of prescribed burning, a written burn plan establishing the criteria necessary for starting, controlling, and extinguishing a burn is required. The burn plan includes details such as specific weather conditions, locations of control lines, ignition pattern, equipment and personnel needed, contingency plans, and important phone numbers. The burn plan is essentially the “prescription” for how to conduct the burn safely while accomplishing the management objectives.

If other invasive species that are stimulated by burning are present on the site, planning should incorporate additional control methods to eradicate them.

Prescribed burning specifics

In fire-adapted communities, prescribed burning can provide effective control of Japanese barberry. Late spring burns with good fuel may kill seedlings and repeated fires can kill mature plants after several years.

Prescribed burning can be used effectively in combination with herbicide. When burning is used first, resprouts can be treated with foliar herbicide application. Alternatively, after an initial herbicide application, burning will injure or kill resprouts.

Burning can also be used as the second step of a two part control effort; following cutting or mowing, resprouts can be burned with a propane torch. Directed flame from the torch should continue until all individual stems begin to glow, turn black and crumble.

Biological control

There are presently no biocontrols for Japanese barberry. Recently, however, the barberry geometer (*Coryphista meadii*), a North American moth, has been noted as causing extensive defoliation of Japanese barberry. Normally it feeds on American barberry and mahonia, neither of which are native to Michigan.

Disposal of plant parts

When seedlings or young shrubs are pulled, they should be disposed of in a manner that will ensure that their roots will dry out completely. In addition, if fruit is present, it should be burned or bagged and placed in a landfill.

Although landscape waste cannot generally be disposed of in land fills, Michigan law permits the disposal of invasive species plant parts. See the “Online resources” section for a link to the relevant legislation.

Online resources:

CDMS - herbicide labels:

<http://www.cdms.net/LabelsMsds/LMDefault.aspx?t=>

Fire Effects Information System, *Berberis thunbergii*

<http://www.fs.fed.us/database/feis/plants/shrub/berthu/all.html>

Invasive.org, Japanese barberry

<http://www.invasive.org/browse/subinfo.cfm?sub=3010>

DCNR Exotic Invasive Plant Tutorial for Natural Lands Managers, Japanese barberry and European barberry

http://www.dcnr.state.pa.us/forestry/invasivetutorial/japanese_euro_barberry.htm

Invasive Plant Atlas of New England, Japanese barberry

http://www.eddmaps.org/ipane/ipanespecies/shrubs/Berberis_thunbergii.htm

Midwest Invasive Species Information Network, Japanese Barberry

<http://www.misin.msu.edu/facts/detail.php?id=14>

The Michigan Department of Agriculture and Rural Development—Pesticide Certification

www.michigan.gov/pestexam

The Michigan Department of Environmental Quality—Aquatic Nuisance Control

www.michigan.gov/deqinlandlakes

http://www.michigan.gov/deq/0,4561,7-135-3313_3681_3710--,00.html

Michigan Department of Natural Resources—Local DNR Fire Manager contact list

http://www.michigan.gov/dnr/0,4570,7-153-30301_30505_44539-159248--,00.html

Michigan's Invasive Species Legislation

Natural Resources and Environmental Protection Act 451 of 1994, Section 324.4130

<http://legislature.mi.gov/doc.aspx?mcl-324-41301>

Michigan Legislation—landscape waste, disposal of invasive species plant parts

Natural Resources and Environmental Protection Act 451 of 1994, Section 324.11521, 2 (d)

<http://legislature.mi.gov/doc.aspx?mcl-324-11521>

The Nature Conservancy's Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas

<http://www.invasive.org/gist/handbook.html>

University of Michigan Herbarium - Michigan Flora Online

<http://michiganflora.net/>



Quick reference - Japanese barberry

This chart has been provided as a convenience, to summarize the pros and cons of each herbicide and to present details on adjuvants, concentrations, etc. that do not fit into the discussion in the preceding sections. Although every attempt has been made to ensure accuracy, the product labels for the listed herbicides are the ultimate authority for their usage. Where there are conflicts, always follow the label directions. Techniques are listed in order of general preference by MDNR Wildlife Division staff but not all are suitable for wetlands or sensitive sites. Site conditions vary—choose a method that is best suited to conditions on the site being treated.

Anyone using herbicides in the course of their employment is required to be a certified pesticide applicator. Treatment in wetlands or over open water requires a permit from the Michigan Department of Environmental Quality.

These chemicals are available in a variety of formulations and concentrations. Concentration is listed below as a percentage of the active ingredient (AI) to facilitate use of different products. Always follow all directions on the product label including mixing instructions, timing, rate, leaf coverage and the use of personal protective equipment.

	Herbicide	% A.I.	Adjuvant	Timing	Pros	Cons
Foliar Spray	Triclopyr ester (e.g., Garlon 4 Ultra®)	2-3%	Use a non-ionic surfactant (e.g. Cygnet Plus®, Nu-Film IR®).	After spring sap flow, while plant is actively growing but before leaves change color. Fall may be best as many natives go dormant earlier.	Broad-leaf specific—will not harm sedges and grasses.	Since it must be used during the growing season, it is not a suitable technique for high-quality sites with many broad-leaf natives. Not approved for use in wetlands.
Cut-stump	Glyphosate (e.g., Roundup®, Rodeo®, Accord®)	27%	Different products have different formulations—follow directions on the label.	Use any time EXCEPT during spring sap flow.	Some products approved for use in wetlands. Less toxic than many alternatives.	Cuts must be treated IMMEDIATELY.
Cut-stump	Triclopyr ester (e.g., Garlon 4 Ultra®)	27%	Use a penetrating oil (e.g., AX-IT®), unless it is already included in product, e.g. Michigan blend.	Use any time EXCEPT during spring sap flow.	Relatively selective herbicide and technique.	Not approved for use in wetlands.
Foliar Spray	Glyphosate (e.g., Roundup®, Rodeo®, Accord®)	1-3%	Some products already contain a surfactant—if not, add one (e.g. Cygnet Plus®, Nu-Film IR®).	After spring sap flow, while plant is actively growing but before leaves change color. Fall may be best as many natives go dormant earlier.	Some products approved for use in wetlands. Less toxic than many alternatives.	Non-selective!!!!!! Use only when few or no natives are present.

