Michigan Department of Natural Resources
Michigan Natural Features Inventory
4/2012

Black and Pale Swallow-worts

Cynanchum louiseae (Vincetoxicum nigrum) and Cynanchum rossicum (Vincetoxicum rossicum)

Black swallow-wort is native to southwestern Europe, around the Mediterranean, and northerrn Europe. Pale swallow-wort is native to the Ukraine and parts of Russia. They were introduced in the US in the 1800s, though neither was ever highly rated as a horticultural specimen. Both black and pale swallow-worts are highly invasive; they form dense monocultures in shade or full sun.

Swallow-worts produce compounds with anti-bacterial and selective anti-fungal properties, and inhibit the growth of many pathogens. The roots contain haemolytic glycosides, which are toxic to mammals, including livestock.

Swallow-worts are also distasteful to many insect larvae and toxic to some, including monarchs. It is not clear how often female monarchs lay eggs on swallow-wort, but when they do, the caterpillars die.

In New York state, swallow-worts pose a particular threat in alvar, where they out-compete a number of rare plant species and disrupt nesting by grassland birds. In general, insect diversity and abundance is significantly lower in dense stands, with cascading effects on the entire food chain.


Suzan Campbell, MNFI

Identification

Habit:
Black and pale swallow-worts are both herbaceous perennial twining vines with clear, watery sap. They commonly reach 1-2 m (3-6.5 ft) in length.

Leaves:
Swallow-wort leaves are opposite, with smooth margins. They are shiny dark green, and narrowly oval or heart-shaped, with sharply pointed tips. The leaves are about 5-13 cm (2-5 in) long and 2-6.5 cm (1-2.5 in) wide.


Suzan Campbell, MNFI

Stems:
Swallow-wort's twining stems are covered with downy hairs. Dried stems and empty seedpods persist into fall or longer.

Black swallow-wort flowers:


Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Black swallow-wort flowers are small, dark purple, and have 5 petals covered in fine light hairs. The bluntly triangular petals are about as wide as they are long.

Pale swallow-wort flowers:


John M. Randall, The Nature Conservancy, Bugwood.org

Pale swallow-wort's flowers range from pink to deep burgundy in color. The narrow petals are longer than they are wide. Both pale and black swallow-wort flowers are held in clusters that attach at the leaf bases. In Michigan, they begin blooming in June.

Fruits/Seeds:
Both species develop milkweed-like pods that split when the seed is ripe. The flat, brown seeds are attached to fluffy hairs that help them disperse by wind in the fall.


Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Habitat
Both swallow-wort species thrive in a wide range of settings and are shade tolerant. They occur along roadsides, in gardens, old fields, pastures, forests, alvar and along the upper edge of fens. They can tolerate brief periods of flooding but not prolonged inundation.

Similar species

Milkweeds

The related native milkweeds (*Asclepias* spp.) are upright, rather than twining vines. Although they also have opposite leaves and similar seedpods, their flowers are far more elaborate and they usually have milky sap.


Suzan Campbell, MNFI

Dogbanes


Suzan Campbell, MNFI

The related native dogbanes (*Apocynum* spp) are also upright—not twining vines. Like swallow-wort, they have narrow seedpods, but their bell-shaped flowers are arranged in clusters at the stem tips rather than along the stems at the base of the leaves.

Oriental bittersweet

The invasive non-native vine Oriental bittersweet resembles swallow-wort but can grow much longer. Its leaves are alternate, with toothed margins, rather than opposite, with smooth margins. It is woody, not herbaceous.


James R. Allison, Georgia DNR, Bugwood.org

Dogwood species

Young native dogwoods can be mistaken for swallow-worts before they are large enough to branch as their opposite leaves have a similar shape. They are woody, however, not herbaceous. They are also easier to distinguish in fruit or flower.

Quick check

Swallow-worts ALWAYS:

- have clear, watery sap
- have opposite leaves
- twine around each other or a support or trail along the ground—they do not stand upright without support.

Reproduction/Dispersal

Swallow-worts reproduce by seed. They are able to self pollinate although sexual reproduction is more common. The role of vegetative reproduction is not entirely clear. Both species have short underground rhizomes but they do not appear to give rise to new plants with any frequency. However, root crown fragments can regenerate when damaged or broken.

Some seeds are polyembryonic; a single seed can contain two or more embryos, and give rise to multiple seedlings. This condition is more common in pale swallow-wort than black swallow-wort. Seed usually lands within a few meters of the parent plant but may be carried several hundred meters by gusts of wind. Little information is available on the development of seed banks.

Although seedling survival is high, plants initially grow slowly and do not reproduce for several years. It can take a number of years for a single plant to mature, produce seedlings and form a small population.

In general, plants in full sun produce more flowers, seedpods and seeds. In high density stands of pale swallow-wort, seed densities of up to 32,000 seeds per square meter have been documented.

Plants in larger colonies (> 80 plants) tend to be more robust and produce more fruits per plant than single plants or those growing in small groups (< 9 plants). Some of this effect can be explained by density; intertwining plants shade out other vegetation more effectively. However, other factors clearly play a role.

Both pale and black swallow-wort form associations with beneficial arbuscular mycorrhizal fungi (AMF). These associations result in improved nutrient cycling. Root colonization rates by mycorrhizae are higher in swallow-wort than in native species growing in the same area. Similarly, four times more AMF spores are present in soils with swallow-wort than in uninvaded soils nearby.

Swallow-wort seedling survival rates are higher in soil with AMF than sterilized soil. Seedling densities of up to 5,000 per square meter are common in large infestations, and can reach 10,000 per square meter. Dense swallow-wort vegetation facilitates the exposure of seedling root systems to the AMF network and results in enhanced nutrition. In general, plants are taller, with more leaves and greater biomass when growing in the large populations where AMF thrive.

AMF species are often species host specific. While generalists can form associations with many host species, some species can only form associations with a few related host species. Swallow-wort encourages the increase of generalist AMF species at the expense of the more specialized AMF species that native plants need to grow and thrive.

Both black and pale swallow-wort appear to be allelopathic. Swallow-wort root extracts can cause root length reductions of 40% in the related butterfly milkweed, for example. Similarly, they have a negative effect on shoot growth in common milkweed. Allelopathic effects could be amplified

in larger, denser populations.

The potential for swallow-wort mediated changes in soil chemistry or mycorrhizae should be considered in any plans for restoration following swallow-wort control efforts.

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 both the scope of the problem and any available resources is a critical first step:

- Map known populations. Are swallow-worts widely distributed throughout the region? Or are they just beginning to appear? Are one or both species present in the area?
- Identify potential dispersal pathways; do infestations lie in the path of road-mowing crews that might spread it further?
- How is it distributed? Is it sparsely scattered in otherwise native vegetation? Does it cover large expanses of low quality habitat? Does it occur in both open and shaded sites?
- Are volunteers available to assist with control?

Given this information, develop a strategy for control:

1. Prioritize high value sites where success can be achieved for treatment.
2. Choose appropriate control methods, given site conditions and available resources.
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. Eradicate small infestations before they can benefit from the effects of large population size (< 81 plants).
6. Focus initially on plants in full sun, which produce more seed.
7. Treat larger core infestations of lower value as resources permit; work from the perimeter and move inward.
8. Monitor to ensure desired results are being achieved; adapt management to improve success.

Best survey period

Swallow-wort turns a conspicuous yellow in late summer and can be distinguished from other vegetation. Begin surveying in open areas, as plants growing in full sun complete fruiting and die back earlier than plants in shade. Plants in shade may continue active growth into September.

Swallow-wort infestations can also be identified in winter, as empty seedpods persist on the dead stalks for a year or two. The presence or absence of dead stalks and seedpods can also be helpful in assessing spread within an area, as new plants will not have them.

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 black and/or pale swallow-wort are first encountered in a county where they had not been known previously, specimens should be submitted to the Herbarium to document their presence. Check the "Online Resources" section for links to both of these resources.

Control

Controlling large populations of swallow-wort requires a multi-year effort. It is important to keep isolated plants or small infestations from expanding into the large populations in which plant vigor and productivity are enhanced.

Multiple strategies should be employed to achieve these ends; techniques that are effective in grasslands and old fields may not be effective on forested sites. Seed production is highest on sunny sites, which should be prioritized for treatment.

Plans for re-vegetating sites should be incorporated into control efforts. Newly exposed sites are vulnerable to re-invasion or colonization by other problem species.

Yearly monitoring is required to ensure that any seedbank is exhausted or when source populations are nearby.

Mechanical control

Mechanical controls alone are rarely adequate to control swallow-wort, except in the initial stages of invasion. They can provide a valuable supplement to chemical controls however.

Hand-pulling/Digging

Pulling swallow-wort is ineffective, but plants may be dug out if entire root crown is removed. This is most appropriate for small satellite populations where only one or a few plants are present.

Cutting/Mowing

Cutting and mowing stimulate sprouting from the root crown, resulting in denser infestations the following season.

They may be used to prevent seed set if the benefits of reducing seed production are believed to outweigh the drawbacks, but they are a temporary step rather than a long term solution.

Plants should be cut after flowering as pods are just beginning to form, but before seeds begin to mature. In open fields, this may adversely affect nesting grassland birds. If it is cut earlier, plants are more likely to flower again. After cutting, new flowers will bloom while the plant is still quite short. Monitor carefully as cutting or mowing must be repeated several times in the same season, and even then, some seed will still be produced.

Pod removal

Where pods have formed following herbicide treatment or mowing, removing the pods will minimize the amount of additional seed in the areas. This may be most useful where volunteer labor is available.

Chemical control

Chemical controls are typically used for large swallow-wort infestations but must continue for a minimum of several years. Although herbicide will kill the top layer of plants, younger, smaller plants below will survive and require additional treatment.

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 exam 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®) provides effective control of swallow-wort. It should be applied as a foliar spray twice during the season; first in June, during flowering and again in August. Swallow-wort has a waxy cuticle that normally repels liquid, so glyphosate should be used with a vegetable oil based multi-purpose adjuvant (e.g. SprayTech® Oil) on upland sites or a wetland-approved non-ionic surfactant (e.g., Cygnet Plus®) in wetlands. 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 broad-leaved plants including swallow-wort but does not kill grasses or some conifers, making it particularly useful in grasslands, pastures and old fields. 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 swallow-wort pods begin to develop. It should be applied as a foliar spray once per season. 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®) to ensure that herbicide penetrates swallow-wort's waxy cuticle.

Do not apply herbicides during a drought, as plants will not translocate chemicals effectively.

Foliar application

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.

Prescribed burning

In fire-adapted communities, a prescribed burn may enhance control of black and pale swallow-worts, but can stimulate their growth when used alone. In general, swallow-worts should be controlled before initiating a program of prescribed burning.

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

Prescribed burning alone does not provide effective control of black and pale swallow-wort as it stimulates vigorous resprouting from the root crown.

Burning can be useful in fire-adapted communities once mature swallow-wort has been removed and the native vegetation that provides fuel recovers. When adequate fuel is present, burning will kill seedlings, as they lack the well-developed root crown of mature plants. Over multiple years, it can help exhaust the seedbank.

If left untreated, swallow-worts can alter fire ecology in fire-adapted communities as fuels do not accumulate beneath it.

Biological control

Several species have been identified as potential biocontrols for swallow-wort. Two leaf-eating moth species (*Hypena opulenta* and *Abrostola asclepiadis*) show promise against swallow-worts.

Hypena opulenta is being considered for a trial release at several sites in Connecticut and Massachusetts in 2012.

Disposal of plant parts

Root crowns and root fragments should not be left on the ground or composted as they will resprout. Similarly, seedpods that have been removed should not be composted. They should be burned or bagged and disposed of in a municipal 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, *Cynanchum louiseae, C. rossicum*
http://www.fs.fed.us/database/feis/plants/vine/cynspp/all.html

Invasive.org, European buckthorn
Black dog-strangling vine, black swallowwort—*Cynanchum louiseae*
http://www.invasive.org/browse/subinfo.cfm?sub=3398&start=61

Dog-strangling vine, European swallowwort—*Cynanchum rossicum*
http://www.invasive.org/browse/subinfo.cfm?sub=4260

Invasipedia at BugwoodWiki, *Cynanchum louiseae, C. rossicum*
http://wiki.bugwood.org/Cynanchum_rossicum

Invasive Plant Atlas of New England
Black swallow-wort
http://www.eddmaps.org/ipane/ipanespecies/herbs/Cynanchum_louiseae.htm

Pale swallow-wort
http://www.eddmaps.org/ipane/ipanespecies/herbs/Cynanchum_rossicum.htm

Midwest Invasive Species Information Network
Black swallow-wort
http://www.misin.msu.edu/facts/detail.php?id=36

Pale swallow-wort
http://www.misin.msu.edu/facts/detail.php?id=37

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 - Pale and Black Swallow-worts

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®)	1.5-3%	Use a vegetable oil based multi-purpose adjuvant (e.g. SprayTech® Oil)	June, early July—after flowering, as pods are just beginning to develop but before seeds begin to mature.	Broad-leaf specific - will not harm sedges and grasses. Extremely effective.	Since it is used during the growing season, it may harm broad-leaved natives. Not approved for use in wetlands.
Foliar Spray	**Triclopyr amine** (e.g., Garlon 3A®, Renovate®)	2-3%	Use a wetland-approved non-ionic surfactant (e.g., Cygnet Plus®).	June, early July—after flowering, as pods are just beginning to develop but before seeds begin to mature.	Safe for use in wetlands. Broad-leaf specific - will not harm sedges and grasses.	Since it is used during the growing season, it may harm broad-leaved natives. May be slightly less effective at a given percentage than the ester formulation.
Foliar Spray	**Glyphosate** (e.g., Roundup®, Rodeo®, Accord®)	1-3%	Use a vegetable oil based multi-purpose adjuvant (e.g. SprayTech® Oil) or a wetland-approved non-ionic surfactant (e.g., Cygnet Plus®) with products that are approved for wetlands.	Two treatments needed: June, August.	Some products approved for use in wetlands. Less toxic than many alternatives.	Non-selective!!!!!! Use only when few or no natives are present.