

Ecology and Management of Yellowflag Iris (*Iris pseudacorus* L.)

By

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Figure 1. Yellowflag iris flowers. Photo by Jane Mangold, Montana State University, Bozeman, Montana.

Abstract

Yellowflag iris is a long-lived perennial with showy yellow flowers, long sword-shaped leaves and a stout rhizome with black sap. It reproduces both by seed and splitting rhizomes that are spread by water currents. It is invasive in riparian areas where it can form dense, persistent populations that limit the abundance of native species important to ecosystem function. It is unpalatable to livestock and wildlife. The management priority for Yellowflag iris is early detection and rapid response because management of well-established populations is costly and long-term. Control options are limited to digging and grubbing rhizomes or applications of glyphosate with an aquatic label.

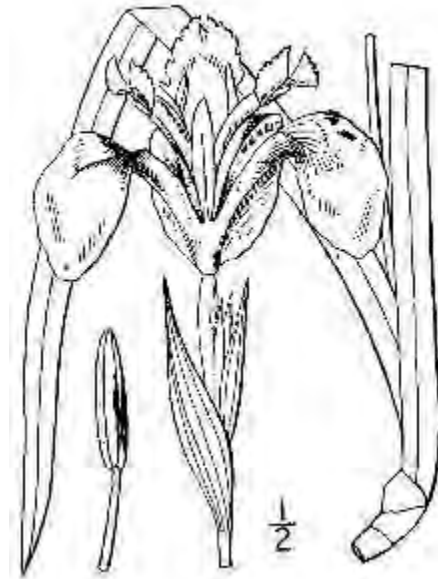


Figure 2. A sketch of yellowflag iris stem, leaves, flower and seed pod.

PLANT BIOLOGY

Identification

Yellowflag iris grows from a stout rhizome ranging in diameter from 0.4 to 1.6 inches (1-4 centimeters). The sap of the rhizome is black. Roots are normally four to eight inches (10-20 centimeters) long, but may reach lengths of 12 inches (30 centimeters). The hairless (glabrous) plants form clones when rhizomes separate. Each individual (ramet) produces 10 leaves covered with a fine waxy powder giving the leaves a whitish or bluish (glaucous) cast. The sword-shaped leaves have a raised midrib and are about 0.4 to 1.2 inches (10-30 centimeters) wide. Leaves range from 20 to 40 inches (50-100 centimeters) in length, or about as long as the flowering stem. Typical of iris, flowers form on a leafless stalk (peduncle) that is round in cross-section and is often branched. Beneath each flower is a large solitary bract (spathe), with thin, dry, margins that lack green color (scarious). Flower pedicels are about 1.5 to three inches (4-8 centimeters) long, about the length of the ovary. Flowers are about three to four inches (8-10 centimeters) in diameter, and vary in color from pale yellow to nearly orange, pale yellow being the most common color (see Figure 1). There are six perianth segments (sepals and petals) fused at their bases to form a tube and situated on top of the ovary (see Figure 2). The sepals are variable in form but generally curve outward, have short claws, are commonly purple-veined, and have an orange spot near the base. The petals are smaller than the sepals and curve upward. The style has three petal-like yellow branches, and on the underside near the tip, is a small lip-like stigma. The three stamens are hidden beneath the three style branches. The elliptic capsules are 1.5 to three inches (4-8 centimeters) long and have three chambers each with two rows of seeds. The seeds are smooth, disc-shaped, and variable in size, turning dark brown when mature.

Identification of yellowflag iris should be fairly easy because only two species of *Iris* are known to occur in Montana outside of horticultural plantings; one being yellowflag iris and the other being the native Rocky Mountain iris or blueflag iris (*Iris missouriensis*). The native iris has blue to purple flowers so it is unlikely to be mistaken for yellowflag iris when in bloom. When

not in bloom, the two can be distinguished from one another by the leaves or rhizomes. The leaves on the native grow to a height of eight to 16 inches (20-40 centimeters), generally shorter than leaves of yellowflag iris, and the rhizomes of the native iris do not have black sap.

Life History

Yellowflag iris grows from both rhizomes and seeds. Rhizomes increase in size from year to year unless flowering occurs or the rhizomes branch, which typically occurs after flowering. The seasonal accumulation of storage materials in the rhizomes results in annual segments that can be counted to determine their age. Rhizomes have air spaces in the cellular tissues (lacunae) that facilitate survival in low oxygen conditions characteristic of flooding. Carbohydrates are stored in rhizomes, roots, leaf bases, and developing flower shoots. Excavated rhizomes of yellowflag iris continued growing for three months indoors without water indicating they can tolerate extensive drought. Fresh and dried rhizomes and leaves contain glycosides that deter herbivory. Vegetative (leaf) growth on rhizomes can be present all year when winters are mild. Leaf growth peaks in the period from April to June and few new leaves grow after July. Leaves start to die in June.

Most flowers bloom between May and July, but flowering can persist into November. Flowers are pollinated when insects pass between the stamens and the outer perianth segments to obtain nectar, brushing pollen from their backs between the two lips of the stigma. Two flower forms are reported with differences in the distance between the style branches and the outer perianth segments, and thus differ in the insect species that are effective pollinators. In Europe, insect species visiting flowers include the bumblebees (*Bombus pascuorum*, the most common visitor, *B. hortum*, *B. ruderarius*, *B. vestalis* Hymenoptera), honey bees (*Apis mellifera*, Hymenoptera), solitary bee (*Osmia rufa*, Hymenoptera) and the hoverfly (*Rhingia rostrata*, Diptera). Seeds are produced between July and November. European studies found an average of 5.6 seed pods per plant; however the number of seeds per pod varied from 32 to 120 with many seeds undeveloped and not viable.

The percentage of seed that germinate is variable. Laboratory studies found germination of freshly collected seeds was 48 percent at 41 degrees Fahrenheit (five degrees Centigrade). Scarification increased germination to 70 percent and washing seeds with xylene to remove a fat-like substance from the seed coat increased germination to over 80 percent. Most seeds germinate in the spring, but some germinate in the summer. Seeds rarely germinate in autumn. In field situations, 20 percent of the seeds dispersed in October germinated the spring of the next year, with an additional 20 percent germinating the following year.

At germination under normal conditions, the root radical emerges and grows for about five days. The shoot cotyledon sheath emerges on the seventh day, and the first leaf appears on the tenth day. After one month, seedlings can have three leaves, lateral roots, and adventitious roots. The proportion of roots relative to shoots is high during early seedling development, which is believed to prevent the seedling from being washed out of muddy substrates and improves survival.

Habitat

Yellowflag iris forms dense clumps in shallow water and wet places around lakes and ponds, and along streambanks. In Montana it has been collected from shallow water on Nine-pipes Reservoir at 3,000 feet elevation, from Kickinghorse Reservoir, and along irrigation canals in

Lake County. In Missoula County it has been collected from the shores of Salmon Lake, small lakes in the Clearwater drainage, and among cattails along Pattee Creek. In Flathead County it occurred on Lake Mary, in Sanders County along the Flathead River, and in Granite County on a pond on Rock Creek. It has also been reported from Carbon, Wheatland, and Ravalli Counties.

In its native range, yellowflag iris occurs in North Africa and all European countries except Iceland. It is often introduced in garden ponds as an ornamental plant. It is found from sea level to 1,083 feet elevation in Ireland. It grows in a wide variety of soil types ranging from gravel beds on beaches (shingle) where rhizomes grow over bare rock with roots penetrating into underlying soil, to waterlogged clay soils (gleys). It usually grows on sites with continuously high soil-water content, but not necessarily submerged soil, and it can grow on dry sandy soil. Rhizome clumps can form mats floating in water. Yellowflag iris grows on peats and permanently submerged organic and inorganic soils at water's edge. In Europe, it persists in the higher zones of salt marshes and in estuarine water with 24‰ salinity. It is less common on chalk (CaCO_3), but is found in fens and in fen woodland. It tolerates soil pH ranging from 3.6 to 7.7. It requires high levels of soil nitrogen. It is associated with depressions within terrestrial habitats and groundwater seepages. It tolerates high levels of organics and low levels of oxygen.

Spread

Yellowflag iris was introduced to North America as a horticultural plant in the early 1900's. Once established, yellowflag iris spreads by both rhizomes and seed. Local spread by rhizome splitting as a consequence of flowering can form multiple plants in radially spreading clones. In Ireland, large clumps measure up to 66 feet (20 meters) across. In shaded environments such as woodlands, flowering is rare and clones have a linear growth form due to reduced rhizome splitting. Along rivers and streams, flooding may transport rhizomes downstream where they subsequently establish new colonies. Wave action along lake shores may also break-up rhizome clumps and result in establishment of new colonies along the shore.

Some seeds of yellowflag iris contain air in their seed coats allowing them to float readily. Seeds have been recorded to float for up to two months. Populations of yellowflag iris on the island of Vorso, Jutland (an island of Denmark) are believed to have grown from seaborne seeds; so long-distance dispersal via water currents is certainly possible. Winter flooding has been reported to spread seed that establish new populations on marshes managed by prescribed burns the previous summer. Yellowflag iris continues to be sold through garden dealers and over the internet.

Impacts

Yellowflag iris forms dense colonies in riparian areas where it crowds-out native species, thus reducing plant community diversity. This may result in altered riparian area function and reduced habitat for wildlife and pollinators. In eastern states, reduced native sedges and rushes that support waterfowl is associated with yellowflag iris invasion. Clumps of yellowflag iris may restrict water flow in irrigation and flood control ditches. The glycoside levels in leaves make the plant unpalatable to livestock. Not only do grazers avoid eating the plant, but they avoid grazing palatable plants growing next to dense clumps of yellowflag iris. Animals eating hay containing yellowflag iris commonly experience gastroenteritis. Cattle in Scotland suffered acute diarrhea after eating rhizomes. Yellowflag iris is a skin irritant.

Because yellowflag iris tolerates low oxygen, it lives in areas with high levels of soluble organics and it may reduce the organic load by 25% over one year. Within a 24-hour period, rhizome

reductions of *Escherichia coli* were 50 percent, *Salmonella* 70 percent, and *Enterocoli* 60 percent. It has been suggested that yellowflag iris can remove heavy metals efficiently and economically from wastewater because of its ability to absorb the metals and survive in unfavorable conditions.

MANAGEMENT ALTERNATIVES

In Montana, yellowflag iris is listed as a Priority 2A noxious weed. Priority 2A weeds are common in isolated areas. Where present, populations of yellowflag iris must be contained, or eradicated if possible. Management is prioritized by local weed districts. Therefore, contact your local weed coordinator or county Extension agent if populations are present. Early detection of new populations is important to prevent the spread of this weed. Regular monitoring of riparian areas, particularly near areas of known populations, is also a priority.

Herbicide ^{1/}

Contact your local weed coordinator or county Extension agent for herbicide recommendations that are most effective in your area, and for regulatory information about herbicide application in riparian areas. Glyphosate is the most widely used chemical for yellowflag iris management. A five percent solution of an aquatic label glyphosate (Rodeo®) applied to actively growing foliage in late spring or early summer has been most effective. Glyphosate is a non-selective herbicide and revegetation to provide competition to re-establishing yellowflag iris may be necessary.

Mechanical Removal

Digging or grubbing rhizomes may be effective if all rhizomes are removed. Retreatment to remove missed rhizomes will most likely be necessary. Removed rhizomes should be disposed of in a landfill away from riparian areas. Gloves and skin protection are recommended to prevent skin irritation. Repeated mowing or clipping may prevent seed production or reduce spread by rhizomes by depleting energy reserves. Using mowing equipment that simultaneously applies herbicide (wet blade) may be a way to target yellowflag iris for herbicide control while reducing non-target impacts. Prescribed burning, fertilization or irrigation do not effectively control yellowflag iris. However, flooding may reduce populations if water levels are maintained for over 65 days.

Grazing Management

Yellowflag iris is usually avoided by cattle, sheep, goats, horses, and rabbits because of glycosides in the leaves. Unpublished reports indicate sheep try early season leaves, and cattle eat leaves down to the rhizomes if leaves are present and short in the autumn.

Biological Control

There are no biological control agents developed or approved for the management of yellowflag iris in the United States. A list of species that feed on yellowflag iris is provided by Sutherland (1990).

^{1/} **Any mention of specific products in this publication does not constitute a recommendation by the NRCS. It is a violation of Federal law to use herbicides in a manner inconsistent with their labeling.**

Integrated Pest Management (IPM)

In Montana, populations of yellowflag iris have proven their ability to overtake large areas of riparian systems. Attempts to control these populations have been expensive and met with limited success, while the risks to the integrity of sensitive riparian habitats are high. Therefore, early detection and rapid response are keys to IPM of this weed. Scouting, identification, and removal of population using glyphosate, digging of rhizomes, or their combination are the primary components of yellowflag iris IPM.

References

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