



PURPLE LOOSESTRIFE IN MICHIGAN

Biology,
Ecology,
and Management

Purple loosestrife is an exotic perennial plant that inhabits wetlands of North America. Due to its aggressive growth in wetland ecosystems, purple loosestrife may result in a disruption of native wildlife and vegetation. The colonization of wetland ecosystems by a highly competitive plant like purple loosestrife has captured the attention of state and federal agencies, environmentalists, hunters, and anglers. These groups, as well as scientific journals and magazines have produced an abundance of literature about purple loosestrife. However, quantitative documentation of purple loosestrife's effects on wetland vegetation and wildlife is minimal. Control of purple loosestrife has included hand pulling and chemical applications, but recently there have been more efforts to develop a biological control method.

ARRIVAL IN NORTH AMERICA

Purple loosestrife came to North America from Europe in the early 1800s, most likely in the ballast of ships. It was common practice to dig sediment from exposed tidal flats in European ports and shovel it into ships' holds to stabilize vessels before making transatlantic journeys. In northeastern ports of North America, seamen routinely deposited ballast sediment into the surrounding shoal areas to make room for cargo. Purple loosestrife was one of many European plants

whose seeds were carried in the ballasts and subsequently deposited in America's estuaries. Thereafter, the seeds made their way inland from the Eastern Seaboard through canals and railroad ditches. Enterprising horticulturists brought purple loosestrife rootstock from Europe to plant in North American gardens, where the plant was a welcome addition due to its beauty. It was also considered a useful medicinal plant. Beekeepers welcomed it as an excellent source of nectar and pollen, although the quality of the honey is poor. Purple loosestrife

may have also arrived on imported sheep and raw wool. Abetted by human activity, purple loosestrife firmly established itself in eastern North America throughout the first half of the nineteenth century.

DISTRIBUTION

Purple loosestrife is native to Eurasia, specifically Macedonia (Balkan Peninsula, Southeastern Europe). Its native habitat extends as far north as southern Sweden and Finland, and extends south to the Mediterranean basin in North Africa. It has been introduced to Ethiopia, Australia, Peru, and Chile, and in the twentieth century, purple loosestrife has greatly expanded its territory in North America. It has spread from Newfoundland and Quebec through eastern North America. It has migrated south into Virginia, Missouri, and Texas, and is found in the Pacific states of Washington, Oregon, and California. It was found in 34 states by 1985.

In Michigan it has been found in all counties of the southern Lower Peninsula, in various locations of the northern Lower Peninsula, and in scattered locations across the Upper Peninsula. It is particularly abundant in certain areas around Lake St. Clair, Lake Erie, and Saginaw Bay.



Adapted from drawing
Thompson, Stuckey,
Thompson, 1987. (see
next bibliography)



Ethan Nadeau

BOTANICAL INFORMATION

A mature purple loosestrife plant (*Lythrum salicaria*) stands on average between 6-7 ft (2m) high and is about 4 ft (1.5 m) wide, with 30-50 herbaceous stems arising from a common rootstock. The smooth margined leaves have either an opposite or whorled (circling the stem) arrangement on the stem. Flowers have 5-6 reddish-purple petals. Blooming season is July through August.

The fruit is a very small capsule.

Purple loosestrife can be distinguished from other plants with pinkish to purple flowers in spikes such as fireweed, blue vervain, winged loosestrife, and swamp loosestrife. Purple loosestrife has pubescence (soft hairs), especially on the upper part of the plant. Purple loosestrife also has a larger spike with more showy flowers. Leaf shape and level of pubescence of purple loosestrife is variable¹.

Purple loosestrife's seed output depends on the plant's age, size,

and vigor. A healthy, mature plant can produce up to 2.7 million seeds per year. One wetland study reported a mean density of 410,000/m² of purple loosestrife seeds in the top 2 in. (5 cm) of soil. The sum of seeds from all other surrounding species combined was not equal to this amount of seeds produced by purple loosestrife alone. Purple loosestrife seeds are primarily transported by water. Wind also carries the small seeds, but generally not very far from the mother plant. Seeds can also be distributed on the fur or feathers of animals, or in mud attached to animals or humans. Purple loosestrife is insect pollinated. Key pollinators include honey bees, carpenter bees, bumblebees and several different kinds of butterflies, including the European cabbage white, the common sulfur, and the wood nymph.

HABITAT AND GROWTH STRATEGY

Purple loosestrife thrives in wetlands and along roadsides. Its presence in these areas can often be attributed to either natural or man-made disturbances. Some of purple loosestrife's most common associates in wetland ecosystems are cattails, reed canary grass, and sedges. Purple loosestrife colonizes most successfully in areas of North America where the average minimum temperature is between 20°F and -9°F.

Seeds of purple loosestrife will germinate in water, but seedling establishment is more successful when the substrate is moist but not flooded. Wetland areas that experience temporary drought are often overwhelmed by purple

loosestrife seedlings. Mature adults thrive in a variety of moisture gradients and can survive in moist to permanently flooded areas. The plant is capable of forming aerenchyma (a tissue that allows the plant's roots to exchange gases even though they are submerged in water). Purple loosestrife prefers full sunlight. It can grow in the canopy of other plants or trees, but the stems are elongated, leaf area increases, and fewer flowers are produced.

ECOLOGICAL EFFECTS

The observations of botanists, wildlife managers, and anglers indicate that purple loosestrife causes changes, sometimes drastic ones, when it enters certain areas. Most would agree that wetlands under their surveillance for the past twenty years have withstood a slow, but intense, increase of purple loosestrife. Many observers are concerned with declining waterfowl populations where purple loosestrife is the dominant vegetation. Its dense, stiff stems are inhospitable for many waterfowl. In addition, the plant offers very little food for animals. While deer forage on the new shoots in the spring, other animals, including muskrat, avoid the roots and stems of purple loosestrife. Also, purple loosestrife may lead to a decline in shallow water habitats which are essential feeding and breeding grounds for frogs, toads, salamanders, and some fish. Because its stiff stems collect silt and debris, purple loosestrife can change shallow water habitats into more terrestrial ones, which do not accommodate the feeding and breeding habits of native aquatic animals².



Martha L. Wootler

Purple loosestrife, Saginaw Bay

The previously described ecological effects largely represent the observations and concerns of those who use, manage, or enjoy wetlands. These effects have not yet been substantiated by quantitative studies that measure changes in flora and fauna in response to purple loosestrife. Although there are some studies concerning purple loosestrife's superior competitive ability compared to other wetland species, there are surprisingly few field or laboratory experiments that identify the traits that contribute to purple loosestrife's competitive success or that monitor its colonization in specific habitats over time³.

CONTROL MEASURES

Legal

Each state has its own policy regarding the sale and distribution

of purple loosestrife. In 1995, Michigan passed an amendment to Act 189, of the Public Acts of 1931. The amendment forbids the sale and distribution of purple loosestrife (*Lythrum salicaria*) and the cultivars and hybrids associated with it. (As of January 1, 1997, the sale and distribution of cultivars associated with a closely related species, wand loosestrife (*Lythrum virgatum*) was also restricted.) Some of these cultivars are listed in Table 1 on page 4.

Recent seed germination studies demonstrate that although these cultivars might not have as prolific seed production as their counterpart in the wild, they are capable of producing viable seeds, (capable of growth and development) when fertilized by pollen of wild loosestrife.

Flooding

Flooding can prevent the germination of purple loosestrife seeds or the establishment of its seedlings. The success of this practice seems to depend more on the duration of flooding rather than the depth of water. Two studies reported a decrease in seedling density after eight weeks or more of flooding at various water levels. However, flooding may alter community composition by affecting nearby non-target vegetation. Flooding practices must take into account nearby vegetation before being implemented as an effective purple loosestrife control technique.

Fire

Fire is not an effective means of control because the plants' rootstock is at least 0.8 in (2 cm) beneath the soil surface. This is

too deep for any damage to be done by a surface fire. In addition, purple loosestrife's above-ground vegetation recovers from a surface fire within a week to ten days.

Replacement

In an attempt to thwart the establishment of purple loosestrife seedlings, seeds of other plants, including Japanese millet, reed canary grass, and smartweed, may be planted. This method has limited success since the process of plowing and reseeding is very disturbing to the natural habitat. Also, these replacement species are not necessarily desirable in natural settings.

Hand Pulling

Hand pulling is most effective when a stand is under two years old. This method is labor intensive and needs to be conducted with extreme care so that the purple loosestrife seeds are not disturbed. Although seeds resting below the soil surface have very low germination rates, pulling plants might cause enough disturbance to bring those seeds to the upper layers. Although hand pulling is probably not effective for well-established stands, recently established purple loosestrife colonies might be effectively controlled by hand pulling in conjunction with chemical control.

Chemical

Several herbicides have been examined for control of purple loosestrife. Currently, glyphosphate, sold under the trade name, RODEO® is the only effective purple loosestrife herbicide that is registered for aquatic use. How-



Young purple loosestrife taking root in shallow water.

Martha L. Walter

ever, it is non-selective, meaning that it will also affect the vegetation surrounding the target plant. It is best to spot spray the purple loosestrife to reduce the effect on non-target species, and to avoid clearing open areas that encourage blankets of purple loosestrife seedlings to flourish. Selective herbicides, meaning those that can kill purple loosestrife without severely affecting proximate monocots such as grasses, sedges, and cattails have been researched. They are generally more successful on first year seedlings than full grown stands. Studies about the toxicity of these and other herbicides and their effects on water quality and other wildlife are still being performed^{4,5}.

Biological Control

Use of a pest's natural enemies to regulate its populations and reduce its damage is called biological control. In the mid-1980s, an organized effort to find purple

loosestrife's natural enemies was promoted by the United States Department of Agricultural Research Service (ARS) and the U.S. Fish and Wildlife Service. There was strong motivation to pursue alternative management methods because prior control efforts had been costly, time consuming, and overall not very effective in consistently lowering purple loosestrife populations. A cost-benefit analysis indicated significant potential benefits due

Table 1.

Some loosestrife cultivars that can cross-pollinate with wild purple loosestrife.

-
- Atropurple*
 - Columbia pink*
 - Lady Sackville*
 - Happy*
 - Rose Gleam*
 - The Rocket*
 - Rosy Glow*
 - Brightness*
 - Dropmore Purple*
 - Morden Pink*
 - Morden Gleam*
 - Morden Rose*
 - Rose Queen*
 - Rosy Gem*
 - Firecandle*
 - Floralie*
 - Gypsy Blood*
 - Pink Spires*
 - Purple Spires*
 - Rosy Glow*
 - Flashfire*
 - Florarose*
 - Purple Dwarf*
 - Robert*
 - The Beacon*
 - Tomentosum*
 - Roseum superbum*

*Pesticides must be registered with the U.S. Environmental Protection Agency and the Michigan Department of Agriculture before they can be used legally in Michigan. Remember that the pesticide label is the legal document on pesticide use. Read the label and closely follow all instructions.

to the reduction of purple loosestrife populations. These benefits included an increase in hay and pasture land, fur harvest, migratory bird hunting and outdoor recreation expenditure².

In the search for biological control agents, 120 plant eating insects were associated with purple loosestrife and six were selected for rigorous testing. Of these, one root boring weevil (*Hylobius transversovittatus*) and two leaf eating beetles (*Galerucella pusilla* and *G. californiensis*) have been the most widely studied.

Prior to the widespread release of these insects, experiments were conducted to determine the likelihood of any undesirable impacts. The identity of the beetles was confirmed, and each species determined to be free of parasites or diseases that could be transmitted to plants or other insects. In addition, a series of non-target plant species representing taxonomically related plants, wetland plants and important agricultural species were tested to see if the beetles would attack them. A total of 47 non-target species were recommended for testing by the United States Department of Agriculture, Technical Advisory Group for the Introduction of Biological Control Agents of Weeds (TAG).

Results of these tests showed that even when caged with no other choice of food, the beetles rejected the vast majority of the non-target plants. Minor feeding and egg laying occurred only on three closely related *Lythrum* species. Importantly, few larvae survived to adulthood on these plants, indicating they are very poor hosts. Field studies in Europe showed that when given a more natural choice,

beetles did not lay eggs on any non-target plants. In one case where all the surrounding purple loosestrife was completely defoliated, newly emerging leaf beetles fed on winged lythrum (*L. alatum*) and swamp loosestrife (*Decodon verticillatus*), producing a maximum of 40% defoliation. However, this feeding was not sustained and occurred at a time of year when it was unlikely to affect plant performance. The researchers concluded that all three beetles are highly host-specific and cause only minor damage to any non-target plants^{6,7}.

Based on these studies, these insects have been approved for release in the U.S., and as of the summer of 1996, twenty-one states have received the root weevils and up to twenty states had received both species of leaf beetles. In Michigan, the leaf eating beetles were first released by the Department of Natural Resources in 1994 in the Saginaw Bay Watershed. Subsequent releases of the leaf beetles and the root weevil have occurred in southeastern Michigan. Additional efforts to rear and redistribute these natural enemies are underway and studies continue to monitor their establishment and success in combating purple loosestrife.

BIOLOGICAL CONTROL PROGRAM IN MICHIGAN

Michigan State University and Michigan Sea Grant scientists, along with teaching professionals, are working with local resource managers to engage Michigan K-12 students in an educational program designed to foster youth stewardship of our natural



Galerucella, the leaf eating beetle

systems. Classroom teachers and youth group leaders are employing biological control of purple loosestrife as part of a living laboratory to teach valuable lessons with visible tangible ecosystem impacts. They are practicing loosestrife control in the field while learning about the aquatic ecosystems around them and using alternatives to chemical and other less desirable controls. Lessons learned through the implementation of this program could improve the way we deal with the next exotic species when it comes along, as it surely will.

SELECT BIBLIOGRAPHY

Listed here are writings that have been particularly useful in the making of this fact sheet. By no means is it a complete record of all the materials that were consulted. It serves those who would like to find out more about purple loosestrife.

1. Voss, E.G. Michigan Flora, Part II. Cranbrook Institute of Science and University of Michigan Herbarium, 1985.
2. Thompson, D. Q., R.L. Stuckey, E.B. Thompson. Spread, impact and control of purple loosestrife (*Lythrum salicaria*) in North American Wetlands. U.S. Dept. Int. Fish and Wild. Ser. Research 2, 1987.
3. Anderson, M.G. Interactions between *Lythrum salicaria* and Native Organisms: A critical review. *Env. Manag.* (19) 225-231, 1995.
4. Mal, T.K., J.L. Lovett-Doust, L. Louvett-Doust, and G.A. Mulligan. 1992. The Biology of Canadian weeds. 100. *Lythrum salicaria*. *Can. J. Plant Sci.* 72:1305-1330.
5. Skinner, L.C., W.J. Rendall, and E.L. Fuge. Minnesota's Purple Loosestrife Program: History, Findings, and Management Recommendations. Minnesota Department of Natural Resources. Division of Fish and Wildlife. Ecological Services Division. Special Publication No. 145, 1994.
6. Blossey, B., D. Schroeder, S.D. Hight, R. Malecki. Host Specificity and Environmental Impact of Two Leaf Beetles (*Galerucella californiensis* and *G. pusilla*) for Biological Control of Purple Loosestrife (*Lythrum salicaria*). *Weed Science* 42:134-140, 1994.
7. Blossey, B., D. Schroeder, S.D. Hight, R. Malecki. Host Specificity and Environmental Impact of the Weevil (*Hylobius transversovittatus*), a Biological Control Agent of Purple Loosestrife (*Lythrum salicaria*). *Weed Science* 42:12, 1994.

Research and writing for this Bulletin by Sarah Stackpoole, Michigan Sea Grant.

PROJECT CONTACTS, THE PURPLE LOOSESTRIFE PROJECT AT MSU

Carol Swinehart
Michigan Sea Grant
phone: 517-353-9723
fax: 517-353-6496
email: cys@msu.edu

Doug Landis
Associate Professor of Entomology
Michigan State University
phone: 517-353-1829
fax: 517-353-5598
email: landisd@msu.edu

Bulletin E-2632
MICHU-SG-97-501

The Michigan Sea Grant College Program is a cooperative program of Michigan State University and University of Michigan. Funding is by the National Oceanic and Atmospheric Administration (NOAA).

MSU is an affirmative action equal opportunity institution. Extension programs and materials are available to all without regard to race, color, national origin, sex, handicap, age or religion. Issued in furtherance of Extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. References to commercial products or trade names does not imply endorsement by Extension or bias against those not mentioned. This bulletin becomes public property upon publication and may be printed with proper credit.



www.miseagrant.umich.edu

MICHIGAN STATE
UNIVERSITY
EXTENSION

