# Agrichemical and Environmental News

**A Monthly Report on Pesticides and Related Environmental Issues**

**April 2002 • Issue No. 192 • http://aenews.wsu.edu**


# Outsmarting The Purple Foe

## Battling Purple Loosestrife with Biological Control


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Purple loosestrife (*Lythrum salicaria*) is an aggressive, herbaceous, semiaquatic perennial that became naturalized in North America following introductions from Europe in the early 1800s. The plant's rapid spread throughout the northeastern United States and southeastern Canadian provinces by the late 1800s was most likely facilitated by the dumping of ships' ballast soil containing seed and the presence of seed in livestock bedding, forage, and wool. It was also encouraged by deliberate plantings for ornamental and medicinal purposes. As a result, purple loosestrife soon became established throughout much of temperate North America. Its invasive nature has been cause for great concern.

***Purple loosestrife infestation in Grant County, Washington.***


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Purple loosestrife extended its range into the western United States over the last half century. Its presence has distressed wetland ecologists, conservationists, and outdoorsmen. *L. salicaria* thrives in wetlands, wet pastures, drainage ditches, irrigation canals, and floodplains of freshwater streams, rivers, lakes, and ponds. Over 75% of Washington counties have reported infestations. The most heavily impacted areas are located along the Frenchman Hills and Winchester Wasteways of Grant County and adjacent to the Columbia, Okanogan, Snake, and Yakima rivers.

In heavily affected areas, stands of the weed dominate, displacing wildlife-supporting vegetation and offering little or no value to the ecosystem. The resulting degradation in plant species diversity can permanently displace certain birds and mammals. Infestations also impact water-based recreational activities by decreasing the storage capacities of water bodies, clogging irrigation ditches and canals, and increasing silt. In short, the presence of purple loosestrife can be both ecologically and economically undesirable.

## Know Thine Enemy

Purple loosestrife is a member of the loosestrife family (Lythraceae). The plant has a strong affinity for moist or saturated soils. It occasionally may be found in drier sites but plants are not as vigorous as those found in wetter soils. Watercourses and wetlands having shade-covered areas are less susceptible to invasion and colonization by purple loosestrife.

An established plant produces multiple semi-woody, upright stems that can range in height from 1.5 to 10 feet. These stems are killed by fall frosts but they do not readily decompose. The dead stems remain attached to the root crown for several years, contributing to the impenetrability of the stands.

Purple loosestrife leaves are usually 1.2 to 4 inches long. Upper leaves are smaller, are lance-shaped with heart-like bases, and lack petioles. Lower leaves are arranged in an opposite formation or in whorls of three, while upper leaves are alternate. In the fall, the leaves turn yellow, orange, red, and purple before dropping from the plant.

***Purple loosestrife in flower.***

The weed has a dense, woody root system comprised of an abbreviated taproot and lateral roots with numerous shoot buds. The roots of adjacent plants intertwine to form a dense mat that makes it difficult, if not impossible, to successfully uproot individual plants. The root mat also provides a physical barrier that discourages establishment of other plant species.

Purple loosestrife is most easily identifiable during late June to early September when it is flowering. Flowering occurs in dense terminal spikes of numerous, small, rose-purple flowers from a few inches to more than three feet in length. An averaged-sized plant can produce up to three million minute seeds annually. Seeds disseminate primarily by drifting in moving water, but can also be transported long distances in mud adhering to wildlife, livestock, humans, and vehicles. The plant can also reproduce vegetatively by resprouting from cut stems and regenerating from rootstock fragments.

## Management Tactics

Management options have included mowing or clipping, grazing, burning, water level manipulation, hand pulling or digging, and herbicide applications. Some of these methods work very well with small populations, but all are very costly to implement and usually require repeated application for long-term control. Additionally, some methods may be environmentally undesirable.

Unquestionably, the most ecologically sensitive, cost-effective, and sustainable purple loosestrife management approach is biological control. Biological control involves the intentional release of host-specific organisms to reduce a weed's distribution and abundance. The overall goal is to reduce the density of the target plant to a level where it is no longer an ecological or economic threat to its environment.

***Loosestrife killed by* Galerucella *spp. feeding.***

Currently, several insect natural enemies are being used to combat populations of purple loosestrife across the United States and Canada. These include the bud- and foliage-feeding beetles *Galerucella calmariensis* and *G. pusilla*, the root-feeding weevil *Hylobius transversovittatus*, and the seed-capsule-infesting weevil *Nanophyes marmoratus*. Federal and state regulatory officials have sanctioned the importation and release of these organisms in the United States. Initial releases of *G. calmariensis, G. pusilla*, and *H. transversovittatus* were made in 1992 in Washington and *N. marmoratus* was first released in 1996.

## Natural Enemy Profiles

Overwintered *Galerucella* spp. adults appear in May and feed upon young purple loosestrife leaves. Females lay eggs in clusters of two to six on stems, leaves, and leaf axils from mid-May to mid-July. Upon hatching, groups of larvae feed upon leaf and flower bud tissue, whereas older larvae primarily consume leaves. The larvae pupate within the soil and the first generation

***TOP:* Galerucella *Larvae feeding on loosestrife foliage.***
***MIDDLE:* Galerucella *spp. Adults.***
***BOTTOM: Root-infesting weevil adult.***

adults emerge and appear on plants in early summer. These adults feed and lay eggs through September, after which time they seek overwintering sites amongst soil debris. Results of larval feeding include reduction of shoot growth and prevention of flower and seed formation. High densities of both the adults and larvae result in complete defoliation and plant mortality. Of the biological control insects studied, *Galerucella* spp. have the most dramatic visible impact on purple loosestrife. In Grant County, entire stands of the weed have been decimated through the constant defoliation and associated depletion of root reserves caused by these beetles.

*Hylobius transversovittatus* adults emerge from their overwintering sites and are evident on purple loosestrife in early May. The adults feed at night upon the margins of purple loosestrife leaves. Females start to lay eggs shortly after emergence and continue to do so through September. Each female produces approximately 300 eggs at the rate of one to three per day. The eggs are deposited into the soil near the plants' roots or directly into the stems near the soil surface. Once the eggs hatch, larvae tunnel into the roots where they feed upon the rich carbohydrates and nutrients stored within. Larvae will feed within the roots for one to two years before pupating within the damaged roots. Only a single generation is completed annually. Injury to the plants includes stunted growth and fewer stems, which result in less seed. Complete destruction of the roots can occur when multiple larvae attack a plant over several consecutive years.

*Nanophyes marmoratus* has been proven to complement both *Galerucella* spp. and *H. transversovittatus* in European studies and was thus introduced to supplement the biological control effort in North America. Adult beetles emerge in late April to early May and initially feed upon the newly unfolding tender leaves and shoots of purple loosestrife. As the plant continues to develop, the beetles move up onto the developing flower heads and begin mating and feeding upon the closed flower buds. Egg laying occurs from June through September. Females will deposit from 60 to 100 eggs singly into separate immature flower buds during this time. Upon hatching, the larvae begin consuming the undeveloped internal portions of the flower, including the ovary. Pupation takes place within the damaged buds. The buds remain closed and seldom drop prematurely. The newly formed adults chew a hole through the flower bud wall to emerge in late summer, when they feed on any remaining leaves of the purple loosestrife before seeking out their overwintering sites in the soil. This beetle completes one generation per year. High infestations of the adults can cause initial stunting of plants. European studies have shown that the larvae and adults collectively can reduce potential seed output by up to 60%. Further research will determine how effective these beetles are against purple loosestrife in Washington State.

**Nanophyes *adults.***

## Living with the Enemy

Biological control does not promise elimination of the designated target. Typically, some plants escape the control measures. However, the efficiency and endurance of a biological control program, especially when integrated with other proven management techniques, can reduce invasive weed populations to much more tolerable levels. The outlook for further suppression of purple loosestrife in Washington and other areas of the United States using biological control appears to be extraordinarily promising.

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