

Biological Control of Invasive Forest and Landscape Pests: An Overview of Current Problems[©]

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Birch Leafminer (*Fenusa pusilla*). Birch leafminer (BLM), native to Eurasia, was introduced to Connecticut in 1923. It spread throughout the Northeast and Midwest, causing nearly complete defoliation of landscape and roadside white and gray birches. In Europe BLM is widespread, but relatively scarce — apparently because of 17 species of parasitoids which cause 38%–47% annual parasitism. In recent decades the European parasitoid *Lathrolestes nigricollis* was released in mid-Atlantic and southern New England states. Now BLM is rare and parasitism is high except south of mid-New Jersey.

Winter Moth (*Operophtera brumata*). Winter moth, native to Europe was found in 1935 in Nova Scotia and New Brunswick. In 1950 it was discovered in Washington and Oregon and in 1977 in British Columbia. A new introduction was found in 1996 in Southeast Massachusetts which by 2004 spread to Rhode Island. North American hosts include: Norway maples (*Acer platanoides*), birches (*Betula*), apple (*Malus*), red oak (*Quercus rubra*), blueberry (*Vaccinium*), ash (*Fraxinus*), and rhododendron (*Rhododendron*). Males emerge in November and seek flightless females that crawl up trees to mate and lay eggs. Males are attracted to lights! Females lay eggs in cracks in tree bark in November. Eggs hatch around bud break (March and April). Larvae feed on buds, then leaves, completing development and pupating in the soil in May. A European fly, *Cyzenis albicans* (Diptera: Tachinidae) provided excellent control in the Canadian Maritimes and in Pacific Northwest about 6–8 years after release. Joe Elkinton, University of Massachusetts, started releasing this parasitoid in 2005. It is now established in Seekonk, Hingham, and Falmouth in Massachusetts.

Hemlock Woolly Adelgid (*Adelges tsugae*). Hemlock woolly adelgid (HWA), native to China and Japan, was introduced into Virginia in mid 1950s. It has spread from Georgia through Maine, limited in the north by extreme cold. Canadian and Carolina hemlocks are uniquely susceptible. Introduced biocontrol agents appear ineffective. Asian and western North American species are resistant. *Tsuga heterophylla* is the best match for *T. canadensis*. Small stands of HWA-resistant *T. canadensis* were located in Connecticut and New Jersey. University of Rhode Island is working on improving propagation and distribution. Meanwhile, imidacloprid soil drench provides at least 8 years of protection. The lowest labeled rate is effective and may reduce problems with spruce spider mites.

Emerald Ash Borer (*Agrilus planipennis*). Emerald ash borer (EAB), native to Asia, was found in Detroit in 2002. Initial spread was 30–40 miles per year, but more recently closer to 100 miles/year. I expect southern New England to be infested within 2–3 years. All native ashes (*Fraxinus*) are susceptible. Larvae tunnel beneath the bark, killing trees within a few seasons. Chinese (*F. chinensis*), Manchu-

rian (*F. mandschurica*), and Syrian (*F. syriaca*) ash are all apparently resistant to EAB but may have other problems. Current research includes interspecific hybrids and transgenic (Bt) plants. “Lingering” native ash trees are also under investigation. There are presently no ash species or cultivars to recommend for EAB resistance. Three species of Chinese parasitoids were released in Michigan and nearby states. Establishment is confirmed but it is too early for impact assessment.

Asian Longhorned Beetle (*Anoplophora glabripennis*). Asian longhorned beetle (ALB) was introduced to North America in Chinese shipping materials. If it spreads, it will have a major impact on tourism, and the sugar maple industry, timber, and nursery industries. Key hosts: maple, horse chestnut, elms, poplars, birches, willows. The ALB was found established in New York City in 1998; Illinois in 1998; Hudson County, New Jersey in 2002; Toronto, Canada in 2003; Middlesex/Union Counties, New Jersey in 2004; Richmond County, New York in 2007; Worcester, Massachusetts in 2008; Boston, MA in 2010. Eradication efforts include quarantine, inspections, tree removal, and insecticide treatments. Current status: Illinois ALB population was declared eradicated in 2008, Jersey City — eradicated 2008, New York City — still under way, Worcester — 76 sq. mile quarantine 18,000 trees removed, Boston — infested trees removed July, 2010 with no additional detections. Biological control research is under way, but the emphasis is on eradication.

Purple Loosestrife (*Lythrum salicaria*). Purple loosestrife, native to Europe, was introduced into North America in early 1800s. Dense stands throughout northern U.S.A. and southern Canada displace native plants and animals. This plant is widespread but relatively uncommon throughout Europe where 120 insect species feed on it. Four European beetle species were released in mid-1990s throughout North America. Experience is generally similar to Rhode Island — periods of defoliation/ plant decline followed by beetle decline/plant rebound, then beetle rebound/plant decline, etc. There is now more plant diversity as a result of biocontrol. (You don’t need 100% effectiveness in weed biological control — just give competitive species a chance.) Beetles continue to spread.

***Phragmites australis*.** *Phragmites australis* has become a major pest of wetlands throughout the northeastern North America and the Midwest in recent decades. Problems are due to an introduced European species, not the native North America species. University of Rhode Island and Cornell biocontrol specialists are working with Commonwealth Agricultural Bureaux International (CABI)-Europe to find effective biocontrol agents among the 175 insects that feed on phragmites in Europe. We are presently conducting host-specificity tests on insect species that appear to have potential for controlling exotic phragmites without adverse impact on native stands.

Mile-a-Minute Weed (*Persicaria perfoliata*). Mile-a-minute weed was introduced in the late 1930s to a nursery in eastern Pennsylvania when holly seeds from Japan were planted and mile-a-minute came up with the holly. This “kudzu with thorns” has since spread throughout the mid-Atlantic and the southern New England states. The current biocontrol program looks very promising: a stem-boring weevil, *Rhinoncomimus latipes*, released in mid-Atlantic states and in Rhode Island has established at virtually all release sites and is having a substantial impact on the weed.

Garlic Mustard (*Alliaria petiolata*). Garlic mustard, native to Europe, was introduced to Long Island about 1986 and has since spread through the Midwest. Foliage is toxic so deer won't eat it. (People shouldn't either — it has high levels of cyanide.) Root exudates kill mycorrhizae and inhibit growth of tree seedlings. Garlic mustard infestations are linked to high deer populations (eat plant competitors) and invasive earthworms (turn leaf litter into rooting media). Several European weevils are ready for release as biological control agents.

Japanese Knotweed. Japanese knotweed, *Fallopia japonica*, *F. sachalinensis* and their hybrid were introduced into North America in late 1800s as ornamentals. These are not pests in Japan where native insects and diseases apparently provide control. A psyllid insect (*Aphalara itadori*), introduced in the U.K. this year, will likely be released in North America within 2 years.

Black and Pale Swallow-Worts. Black (*Vincetoxicum nigrum*) and pale (*V. ros-sicum*) swallow-worts, both European species, are targets of biological control research at University of Rhode Island. We are focusing on two European moths that appear to be host specific and offer potential for control.

Japanese Stiltgrass (*Microstegium vimineum*). Japanese stiltgrass, is a widely distributed invasive plant that is not often recognized. We should learn to identify it and not further distribute this annual plant or its seeds through our landscaping efforts.