Biological Control of Mile-a-Minute Weed

Project Background and Initial University of Delaware Research

Mile-a-minute weed, *Persicaria perfoliata* (L.) H. Gross (Freeman and Reveal 2005), formerly known as *Polygonum perfoliatum* L., is an annual Asian vine that invades a variety of habitats in the eastern US, including forested floodplains, streamside herbaceous wetlands, and upland forests, in addition to disturbed areas such as rights-of-way. Mile-a-minute first became established in the US in the mid 1930s at the Gable Nursery in Stewartstown, York County, Pennsylvania, where it emerged with a planting of holly seeds that originated from Japan (Moul 1948). *Persicaria perfoliata* has now invaded 12 mid-Atlantic and northeastern states. Its current range extends from Pennsylvania north to Massachusetts, west to Ohio and south to North Carolina (Hough-Goldstein et al. 2008a, EDDMapS 2010).

Although some native insects have been found feeding on mile-a-minute weed in the US (Wheeler and Mengel 1984), numbers are rarely high enough to have any impact on the plant.

A biological control program targeting mile-a-minute weed was initiated by the Forest Service in 1996, with the aim of finding host-specific insects in the native range that could then be brought to the US to control the plant here. Field surveys and laboratory host specificity tests were conducted in China (Ding et al. 2004) and subsequent testing continued under quarantine conditions in Delaware. A stem-boring weevil, *Rhinoncomimus latipes* Korotyaev (Korotyaev 2006) was determined to be host-specific to mile-a-minute weed (Price et al. 2003, Colpetzer et al. 2004a), and its host specificity was later validated in a field test with closely related members of the Polygonaceae, including two native tearthumbs (Frye et al. 2010). Following a thorough environmental assessment (USDA/APHIS-PPQ 2004), a permit for field release of *R. latipes* was approved in July 2004. Additional work on the feeding behavior of this weevil (Colpetzer et al. 2004b) and development of a rapid germination protocol for the plant (Colpetzer and Hough-Goldstein 2004) set the stage for mass-rearing of this insect, which is currently underway at the Phillip Alampi Beneficial Insects Laboratory, Trenton, N.J. Weevils have been released in ten states since 2004 (unpublished data; Hough-Goldstein et al., 2009).

About Mile-a-minute Weed

Mile-a-minute weed is a prickly, branching, annual vine that germinates in early spring, usually in April or May in the mid-Atlantic region. Vines grow rapidly, climbing over other plants, and attain lengths of 6 meters or more. Flowers are inconspicuous, and iridescent blue berry-like achenes are produced beginning in mid-summer and continuing until the plants are killed by frost in the fall. The plant can tolerate some shade, but does better in full sun: single isolated plants produced more than 2000 seeds in full sun, but fewer than 400 in the shade (Hough-Goldstein 2008). Seeds require a cold period before germinating. Many will germinate underneath dead vines from the previous year, while others are spread by birds, mammals, and water. Mile-a-minute seeds can survive for up to six years in the seed bank, although most seed germinates during the first and second year (Hough-Goldstein et al. 2008a).

Rhinocominus latipes Korotyaev, the mile-a-minute weevil

Adult *R. latipes* are about 2 mm long, and are black, but may be covered by an orange film derived from plant exudates once they start feeding. Adult weevils eat small holes in young leaves of *P. perfoliata* and lay eggs on leaves and stems. After hatching, larvae bore into the stem where they complete development, then exit the stem and drop to the soil for pupation. Development from egg to adult takes about 26 days under laboratory conditions. Weevils are very small, but can be observed directly in the field, especially at the ends of terminals (Fig. 1). The pale yellow eggs have a characteristic peanut shape and are covered by a thin strip of fecal material (Fig. 2); however they are difficult to spot in the field due to their very small size. Characteristic adult feeding holes in leaves are relatively easy to see (Fig. 3). Larval emergence holes at plant nodes (near where ocreae encircle stems or where stems diverge) can sometimes be seen in the field (Fig. 4). Theweevils go through at least three or four overlapping generations during the growing season in the Mid-Atlantic region, with each generation taking about one month to develop. Adults stop producing eggs between late August and late September each year, and adult weevils overwinter in the leaf litter or soil (Lake 2007, Lake et al. 2011).


Fig. 1. Adult weevil

Fig.2. Eggs (with penny)


Fig. 3. Adult feeding damage


Fig. 4. Larval node damage

Photos by Ellen Lake

Impact on mile-a-minute weed

In field cages, weevils were shown to delay seed production, stunt plants by causing loss of apical dominance, and cause mortality of *P. perfoliata* in the presence of competing vegetation (Hough-Goldstein et al. 2008b). In three intensively monitored replicated release arrays in southeastern PA, the population of *R. latipes* increased and mile-a-minute cover, seed production and/or spring seedling counts decreased significantly (Lake et al. 2011). Additional monitored sites with weevil releases have shown substantial reductions in spring seedling densities of the weed within one to three years following release in some areas (Hough-Goldstein et al. 2009).

Damage by *R. latipes* is generally higher in the sun than in the shade (Hough-Goldstein and LaCoss 2011). In 2010, the total biomass of mile-a-minute weed produced by plants in the sun without weevils (where weevils were eliminated using insecticide) was about twice as high as the biomass of plants in the sun with weevils present, or shaded plants with or without weevils present. Both weevils and shade significantly reduced mile-a-minute weed biomass, with the “weevil effect” strongest in the sun and the “shade effect” strongest in the absence of weevils (Hough-Goldstein and LaCoss 2011). Thus, although mile-a-minuteis intrinsically a sun-loving plant, the advantages of growing in the sun can be largely negated by the presence of *R. latipes*.

Conclusions and Next Steps

Biological control is uniquely capable of reducing invasive weed populations through highly specific impacts that are self-sustaining, contributing to the protection of natural ecosystems (Van Driesche et al. 2010). *Rhinoncomimus latipes***has established on mile-a-minute weed wherever it has been released in the US, producing multiple generations per year, and has been shown to reduce mile-a-minute cover and biomass, reduce seed production, and in the presence of plant competition cause mortality of plants. In some areas where mile-a-minute weed has been reduced through biological control, however, the community that has developed has been dominated by other non-native invasive plants, such as Japanese stiltgrass. Therefore, in addition to further work on the biology and impacts of** *Rhinoncomimus* *latipes*, our laboratory will continue to pursue work in the area of restoration ecology, exploring ways of integrating biological control and other control methods to produce the desired outcome **of a diverse native community.**

NOTE THAT IF YOU WISH TO MOVE THE MILE-A-MINUTE WEEVILS FROM ONE STATE TO ANOTHER (OR GET SOME SHIPPED FROM THE NJ LAB TO ANOTHER STATE) YOU MUST HAVE A PPQ 526 PERMIT. TO APPLY, SEE: http://www.aphis.usda.gov/plant_health/permits/organism/index.shtml

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