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Testing of Biological Control Agents for Garlic Mustard Nears Completion

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Garlic mustard (Alliaria petiolata) is one of the few non-indigenous herbaceous species that is able to colonize and dominate the understory of North American forests, both in shaded areas and in open woods and savannas. The declines in native plant species diversity associated with the spread of this biennial European herb have resulted in widespread control efforts using conventional techniques (herbicide, hand pulling, prescribed burns) that often prove to be both expensive and unsuccessful. Therefore, in 1998, a group of researchers in the United States, in cooperation with scientists from the CABI-Bioscience Centre in DelŽmont, Switzerland, launched a biological control program in an attempt to develop an ecologically feasible and economically viable alternative.

Researchers from the CABI initially identified 69 insect species in Europe that feed on garlic mustard (Hinz and Gerber 1998), from which four weevils were selected for further study as promising potential biological control agents. These include two stem miners, Ceutorhynchus alliariae and C. roberti; a root-crown feeder, C. scrobicollis; and a seed feeder, C. constrictus (Blossey and others 2001). These species were selected because garlic mustard is thought to be their sole host plant, and because of the amount of damage they can cause to plant performance and reproduction. The most promising species appears to be C. scrobicollis. In Europe, this weevil is known to feed on 50 percent or more of garlic mustard plants in a stand, often killing the rosettes.

Detailed host-specificity investigations are now being conducted to assure that the four weevils do not pose a threat to native North American species. These tests have focused on plant species that are closely related to garlic mustard, occur in its habitat, or have known chemical similarities. Researchers at CABI have already tested the potential control agents on some 50 to 70 plant species. However, recent taxonomic rearrangements within the large family Brassicaceae, of which garlic mustard is a member, required that they test additional species. In addition, difficulties growing certain North American plant species in Europe have required completion of host-specificity testing at a quarantine facility at the University of Minnesota-St. Paul.

The primary focus of these tests is the root-crown weevil C. scrobicollis, followed by C. roberti and C. alliariae. Test results for all species look very promising, although C. scrobicollis, C. alliariae and C. roberti have attacked two European species in the pennycress (Thlaspi spp.) and yellowcress (Rorippa spp.) genera. While attack of these plant species has never been reported in the field, we plan to test additional North American species in these genera. We expect that host-specificity testing for C. scrobicollis will be completed by fall 2005, with a potential introduction in 2006 if approved by the U.S. Department of Agriculture. The stem miners and seed feeder will probably require an additional season of testing.

In anticipation of future releases of control agents, Bernd Blossey and Victoria Nuzzo have developed a standardized monitoring protocol intended to follow populations of garlic mustard, associated native plants, and the biocontrol agents over time using permanent plots (data record forms and instructions are available at www.invasiveplants.net). Collection of baseline data before control agents are released is essential to allow accurate assessments of effects after release. An early start to monitoring is particularly important for garlic mustard because of dramatic annual population fluctuations, which are, at least in part, due to its biennial life cycle. The standardized monitoring protocol will help distinguish population fluctuations driven by interactions of external factors, such as climate and garlic mustard biology, from population declines associated with release of biocontrol agents. Long-term monitoring plots have been established for several years in New York and Illinois, and additional plots have recently been established using the same protocols in Indiana, Minnesota, Michigan, Wisconsin, Vermont, and New Hampshire.

Many researchers and resource managers have contributed to the development of garlic mustard biological control. This collaboration includes European researchers at CABI, various universities in the United States, state departments of natural resources as well as federal support from the Department of Defense and the USDA Forest Service. Continued funding and cooperative efforts are essential for completion of the research and future introduction of control agents into North America.

REFERENCES

Blossey, B., V. Nuzzo, H. Hinz and E. Gerber. 2001. Developing biological control of Alliaria petiolata (M. Bieb.) Cavara and Grande (Garlic Mustard). Natural Areas Journal 21:357-367.

Hinz, H. L. and E. Gerber. 1998. Investigations on potential biological control agents of garlic mustard, Alliaria petiolata (Bieb.) Cavara & Grande. Unpublished annual report, CABI Bioscience, DelŽmont, Switzerland.