Methods for Garlic Mustard Seed Prevention and Destruction

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Abstract

A common control strategy for garlic mustard *(Alliaria petiolata)*, a profusely seeding European biennial invading North American forests, involves pulling bolting plants before seeds are shed. Harvested plants are either left on-site, or bagged and taken off-site. However, garlic mustard plants can form viable seeds even when harvested before fruits are mature, so both methods of disposal pose risks for continued invasion.

We conducted studies to develop strategies that prevent input of seeds into the seedbank from harvested garlic mustard. We evaluated the ability of bolting plants to form viable seeds when pulled at different flowering stages, and when roots or inflorescences were separated from stems (seed prevention). We also evaluated the seed destruction potential of different materials used to bag plants pulled at an advanced fruiting stage (seed destruction). All experiments were carried out in 2001 in a small forest in Wayne County, Ohio.

Seed prevention treatments were a factorial combination of four flowering stages at plant harvest (≤ 5 or > 5 flowers on May 4, post-flowering on May 21 and 30), and three types of stem separation (removal of roots or inflorescence, neither). Ten plants were used per treatment, with four replicates. Treated plants were spread in a single layer on the litter in 1 m^2-plots, and viable seed formation evaluated indirectly with biweekly seedling counts in spring 2002.

Seedlings (thus viable seeds) were produced for all flowering stages of plant harvest. The two early stages resulted in far lower seedling frequency (31% and 19% of plots) and number (0.3 seedlings/m^2) than the two late stages (88% and 100% of plots, 16 and 19 seedlings/m^2, respectively). Removing the inflorescence or roots from stems did not affect seedling production, suggesting that root and stem resources are not necessary for seed maturation in pulled plants.

Seed destruction treatments involved bagging plants with well-developed fruits (harvested June 10) in one of four bag types (double-layer paper feed, woven-mesh plastic feed, black plastic garbage, no bag), and leaving on-site in 1 m^2-plots. Approximately 500 bolting plants were used per treatment, with four replicates. Seeds were sampled monthly through February 2002 to measure weight and viability (Tetrazolium test). Plots were monitored for seedlings in spring.

All seeds produced by plants bagged in plastic lost viability after two months. After eight months, seed viability differed only slightly among plants bagged with paper (73%) or mesh (70%), or unbagged (90%). Seed weight (3.3 mg initial) after eight months was lowest for plants bagged in plastic (0.5 mg), and did not differ among plants bagged in paper (1.0 mg) or mesh (1.2 mg), or unbagged (1.1 mg).

By mid-April, hundreds of seedlings were present around unbagged plants and those bagged in paper (bags mostly decomposed), and

mesh bags were inflated with growing seedlings. No seedlings were present in or out of plastic bags.

In summary, pulled bolting garlic mustard can produce viable seeds, even when harvested at early stages of flowering. However, the risk is much greater when plants are pulled at advanced stages of fruit development. Removing the inflorescence or roots from pulled stems has no impact on seed production.

Bagging pulled plants in heavy-duty, black plastic quickly destroys seeds, whereas decomposable or porous materials provide only a minor seed destruction benefit. However, bagging plus the off-site disposal required for non-decomposable bags is more resource-intensive than on-site disposal.

Using a "sacrifice area" (an area heavily infested and with low conservation value) for on-site disposal, in combination with pulling at early flowering stages, could minimize the hazards of seed production and spread. The risks of both strategies should be weighed.

Ultimately, a comprehensive control strategy for garlic mustard would include targeting of first-year rosettes as well as second-year bolting plants.