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Use of Endemic Pathogens to Control Garlic Mustard (Alliaria petiolata)

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This report is to summarize the activities and findings in the research project "Use of endemic pathogens to control garlic mustard (*Alliaria petiolata*)". This research project was sponsored by the Division of Wild Life Resources, Illinois Department of Natural Resources in 1995 and 1996.

During the growing season of garlic mustard (March to July), extensive efforts were made to survey and collect diseased plants of garlic mustard in Illinois. Garlic mustard plants with various disease symptoms in localized areas were observed in many natural areas. Disease symptoms include yellowing, wilting, root and basal stem rot, stem canker, leaf blotch, and leaf spots. These diseases occur endemically and are localized, affecting a few plants. Numerous diseased specimens were observed and collected from the following locations: UIUC Allerton Park, Piatt County; Lodge Park, Piatt County; Manito Prairie Natural Preserve, Tazewell County; along Des Plaines River near a canoe launch site, Lake County; Adams Wildlife Sanctuary, Sangamon County; Mississippi Palisades State Park, Carroll County; and Illinois Natural Preserve Site M, Cass County.

Diseased garlic mustard plants were collected from natural areas and brought to the laboratory. For isolation of disease-causing agents, the plant tissues showing disease symptoms were excised and washed in 75% alcohol for 3 minutes, then immersed in 5.25% sodium hyperchlorite for another 3 minutes and rinsed in sterile distilled water for 2 minutes before plating out on potato dextrose agar and nutrient agar. Fungal mycelia growing out of the surface disinfected tissue were hyphal tip isolated onto another agar plate. All isolates were single spored. In case no spores were produced, single hyphal tip isolations were made under a dissecting microscope. A total of eighty-two isolations were made. Attempts were made to identify the fungal isolates and the following fungi have been identified among the 82 isolates: Alternaria spp., Fusarium oxysporum, Fusarium solani, Phoma spp., and Sclerotinia sclertiorum. These fungi are known plant pathogens and some of them have been successfully used in biological control of weed.

Pathogenicity tests were carried out with representative isolates. Fungal cultures are grown in potato-dextrose agar for five days. Fungal spores were collected by flooding the cultures with sterile distilled water and spore concentrations were determined with a hemocytometer. Sterile agar plates flooded with sterile distilled water were used as controls. First year garlic mustard plants were carefully uprooted either from Allerton Park or from west Champaign and were gently soaked in water until roots were free of soil particles. The test plants were placed in fungal spore suspensions for 15 minutes, a standard inoculation procedure for Fusarium spp. The inoculated plants were transplanted into peat-perlite container media in 6-inch diameter pots with two plants per pot and six pots per isolate. Plants were kept in the greenhouse at daytime temperatures ranging from 24° to 28° C, and were watered daily. Disease incidence was assessed by recording the number of plants killed three weeks after inoculation and transplanting.

The greenhouse tests found that a number of isolates that can cause severe disease on garlic mustard plants. These isolates were identified at Fusarium solani. Seventy-five percent of the plants were killed three weeks after transplanting compared to no plants killed in the control treatment. It caused root rot and basal stem rot of garlic mustard. The pathogen was re-isolated from the diseased plants.

Field tests were carried out in west Champaign with those isolates that were found to be pathogenic in greenhouse tests. Disease development was monitored at weekly intervals for seven weeks. Disease development in the natural setting was very slow. The first sign of disease was observed three weeks after inoculation. The general symptoms included yellowing and stunting of garlic mustard plants and leaf curling. Although some plants showed severe symptoms, no significant death rates of plants was observed between the treated and non-treated plants. Seven weeks after inoculation, plants already flowered and began to produce seeds. The pathogen-treated plants may have produced fewer seeds per plant than the non-treated control, the test did not prove the treatment would be effective control of garlic mustard in these applications.

In summary, extensive efforts were made to collect and isolate fungal agents from diseased specimens of garlic mustard. More than 80 isolates of fungi associated with diseased garlic mustard plants were obtained. More than 60 of the isolates have been screened for pathogenicity and 20 isolates were found to be pathogenic to garlic mustard under the test conditions. The field tests showed that although the pathogens can cause sever disease in the fields they did not kill the plants outright or stop seed production. Several explanations would be offered at this juncture. The environmental conditions may not be conducive to development of the disease caused by the pathogens at time of application. Plant disease development is often dependent on environmental conditions with temperature and humidity being most critical. The pathogen may not be an effective parasite of second year plants. The second year plants may have developed resistance to the pathogen.

The funding ($6,000) provided by the Division of Wild Life Resources, Illinois Department of Natural Resources, was very helpful for the development in this research. The fund was used for hiring a part-time assistant (about $4,000), and for supplies for laboratory, greenhouse and field research (about $2,000). The part-time worker assisted in preparing and maintaining the fungal cultures, and participating in greenhouse tests. The student worker not only benefited financially from working on this project, but also gained valuable working experience in mycology, plant pathology and plant ecology.

Current research indicates that an effective and practical biological control for garlic mustard will not be available in the near future, while the pesty weed is becoming increasingly widespread, There are certainly no quick solutions available for this invasive weed. Extensive research through increased funding and concerted efforts is required to work on garlic mustard to discover an applicable and effective integrated approach in order to suppress the rapid spread of garlic mustard.