Information sheet for research on Biological Control of Invasive Knotweeds in Michigan

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https://www.michigan.gov/documents/invasives/MISGP_2019_projects_674240_7.pdf

Written landowner permission is required to conduct research on private land. If you have knotweed infestations on your land that meet the criteria listed below and would like us to conduct research and release the biological control agent, please fill out an authorization form and return it to yoshimo2@msu.edu.

The authorization form that can be completed electronically is located here:

http://mariannaszucs.weebly.com/resources.html

What is Biological Control?

Biological control is the control of a pest through the introduction of their natural enemies. Invasive weed species are often controlled by identifying and releasing herbivores that feed on them in their native ranges. In Michigan, a good example of a successful weed biological control program is the control of purple loosestrife.

Background

Invasive knotweeds comprise three species found in North America that can interbreed with each other. The three species are: Japanese knotweed (*Fallopia japonica*), Giant knotweed (*F. sachalinensis*) and their hybrid, Bohemian knotweed (*F. x bohemica*).

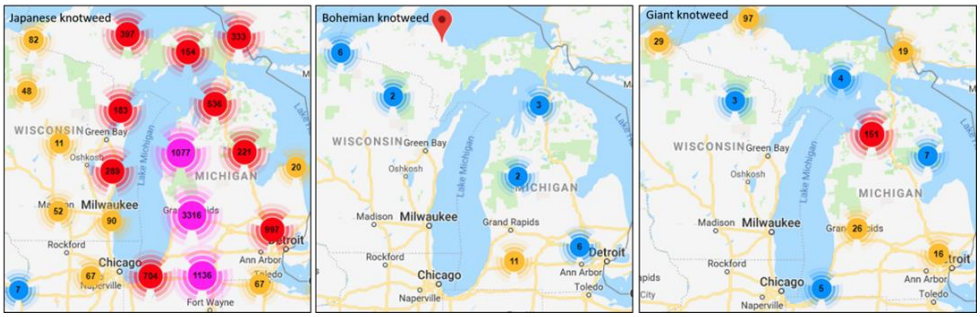

Figure 1. The distribution of Japanese, Bohemian and Giant knotweed in Michigan (from left to right) (misin.msu.edu).

Knotweeds are native to East Asia and are considered a highly invasive weed in North America. They form dense clusters and can cause damage to infrastructure, lower property values and replace native vegetation. They spread rapidly via seeds, root or stem cuttings and are very difficult to kill because of their large and persistent underground rhizome system. Current management methods that combine chemical, physical and cultural control are expensive, labor intensive and often unsuccessful. Biological control could provide long-term reduction in knotweed abundance at a relatively low cost. A natural enemy of knotweeds, the knotweed psyllid (*Aphalara itadori*) originating from the native range of knotweeds in Asia has been approved in 2020 for field release in the USA.

Figure 2. The shape and relative size of leaves from left to right of Japanese, Bohemian and Giant knotweeds. (Grevstad et al. 2018). Differentiating between the 3 knotweed species is important for management purpose because they have different vulnerability to herbicides and to different host races of the knotweed psyllid.

Figure 3. The extensive underground rhizomes make knotweeds very difficult to control.

The Biological Control Agent

Safety

The knotweed psyllid is highly host-specific in its native range, feeding only on knotweeds, which has been confirmed using host-specificity testing in North America as well. These tests included 70 plant species that were native to North America, of economic importance, or endangered. Only 3 plant species were identified as 'marginal' hosts, meaning that eggs were laid, but psyllid development was limited to the first generation, yielding very few adults (1-11 individuals). One additional species was able to support development of the psyllid beyond two generations (*Muehlenbeckia. Axillaris;* Creeping wirevine: an introduced ornamental plant). **Thus, the knotweed psyllid is safe to release, as it cannot develop on North American plant species or on economically important crops.** USDA APHIS has a very thorough permitting process to evaluate exotic biological control agents, and they only approve species that will not pose a danger to native species. The knotweed psyllid has been released in other countries, including the United Kingdom, The Netherlands and Canada.

Biology

Psyllids are commonly called 'jumping plant lice' and have three stages: egg, nymph, and adult. Nymphs are pale yellow to tan in color, but do not have wings and are not very mobile. Adults are tan or orange, and get darker with age. They are very small, measuring only 2 mm long, which is around the size of a sesame seed, and they have tan wings mottled with brown markings. Nymphs and adults both feed on plant sap using their piercing mouthparts. A single female can lay up to 700 eggs, which take about 44 days at 70F to grow into reproductive adults.

Figure 4. Life stages of the knotweed psyllid (a) eggs and an adult; (b) nymphs and crystallized honeydew; (c) adult insect (Photos by F. Grevstad).

Biological Control Research

We are looking for research sites that meet most of the following criteria:

a) Relatively small and dense (0.5-2 acres)
b) At least 5 miles (8km) from other sites in the study
c) Landowners agree not to disturb the site for at least 3 years, and to the placement of permanent markers to track knotweed densities.
d) All other treatments besides biocontrol to be stopped upon releasing the agent (prior treatment is fine)

Work to be conducted

- We will establish permanent monitoring plots using stakes to mark the edges of plots. These plots will be visited by MSU students or staff regularly during the summer and fall in order to take measurements.
- We will release the biological control agent and monitor its establishment success and impact on knotweed stands.
- We will conduct strategic pruning within the plots in order to produce the ideal environment for the psyllids to feed and lay their eggs.
- We may dig out knotweed roots to bring back to the MSU campus to feed our psyllid colonies.