Weed whacker. In the United Kingdom, a little louse (*lower right*) is about to be set loose against invasive Japanese knotweed.

BIOCONTROL

Loosing the Louse on Europe's Largest Invasive Pest

Don't be duped by its delicate pale flowers; Japanese knotweed can be a sinister plant. Native to eastern Asia, *Fallopia japonica* was intentionally introduced into gardens in Europe 200 years ago by fans of its attractive blooms; from there it spread to North America. What makes this invasive weed so menacing is its ability to grow through solid concrete foundations, forcing contractors to abandon infested building sites. In England alone, about a half-million homes are uninsurable, and in the United Kingdom, damages and removal cost $288 million a year.

Now the British government has taken a bold step to solve this knotty problem, and North American researchers might not be far behind. Last week, after more than 5 years of research into the matter and an initial pilot trial, the United Kingdom approved the widespread release of one of the plant's natural enemies. While there are dozens of biological controls already in use against insect pests, this is the first officially sanctioned release of one against a weed in the European Union. "This is an extremely important step. … If this is successful, it will really open the doors and open the minds of people for this control method in Europe," says weed biocontrol specialist Hariet Hinz of CABI Europe in Delemont, Switzerland, a nonprofit agricultural research organization.

The weapon against this goliath of the weed world—Japanese knotweed grows into 3-meter-high thickets—is a 2-millimeter-long plant louse, or psyllid, *Aphalara itadori*, whose release at eight sites across England and Wales has been approved by the U.K. Food and Environment Research Agency and the Welsh Assembly Government. Researchers hope the winged insect will reproduce and gradually spread throughout the country, sucking the life out of knotweed. "We want to start an invasion," says ecologist Richard Shaw, who leads the psyllid project at CABI's outpost in Surrey, U.K.

Finding a useful enemy of the weed was a long process—and getting approval to release it was even more arduous. After all, what comes to most people's minds when one mentions biological control are high-profile ecological disasters, such as the release of the cane toad in Australia. Rather than sticking to their target insect, the cane beetle *Dermolepida albohirtum*, cane toads wound up gobbling everything in sight. But events like this are rare, Shaw says; over the past 100 years, more than 1400 organisms—mostly insects and fungi—have been released against 380 target weeds worldwide, and only 1% of them have been found to feed on plants other than their targets.

Identifying a natural enemy that, unlike the generalist-feeding cane toad, only attacks Japanese knotweed was Shaw's goal. In Japan, Japanese knotweed is common but rarely grows big enough to cause problems thanks to 168 insects and 40 fungi that keep it in check. Four years ago, Shaw and his team brought about 40 potential biocontrol agents back to the United Kingdom for further testing.

A literature search of each species' diet pinpointed nine potential knotweed specialists: a sawfly, two weevils, two beetles, an aphid, a couple of rust fungi, and the psyllid. The team then tested those dietary preferences in the lab. They tried to grow each weed eater on 90 other plant species, including important crops, native U.K. plants, and close cousins of the Japanese knotweed, such as bindweeds. The psyllid proved the most host-specific. It was also the easiest to rear in huge numbers, which is vital for raising enough individuals to release as a biocontrol agent.

In 2010, the U.K. government gave the cautious go-ahead to a limited field trial at two isolated stands of knotweed. After 3 months, the knotweed was still infected with the psyllid. Although it was too early to assess the louse's impact on knotweed, the trials confirmed that it had not spread to close knotweed relatives planted among the knotweed.

Coming up with this biocontrol agent has taken "a tremendous effort to identify and risk-assess," says ecologist Jeffrey Bale of the University of Birmingham in the United Kingdom. Later this month, the researchers will release an estimated 100,000 lab-raised lice at eight sites. At each site, they will monitor that the psyllid continues to be selective about its culinary decisions.

In parallel with these efforts, the psyllid may be released in the northeastern United States and Canada in 2012, says Fritzi Grevstad, an ecologist at Oregon State University, Corvallis, and one of the researchers on the project.

Even critics of biological control are impressed with the evidence Shaw's team has amassed. "It looks like these guys are right on track," says Peter Stilling, an ecologist at the University of South Florida, Tampa. "They appear to have done their homework" with respect to finding a knotweed specialist, he says. However, Stilling remains worried about unforeseen consequences of the release on the whole ecosystem. He cites the example of a fly species that was introduced into the western United States in the 1970s to control knapweed. The fly didn't kill the weed but instead caused it to form hundreds of galls, which provided an enriched food source for mice. These mice carried hantavirus, which causes serious respiratory problems in humans if contracted. As the mice population grew, the rates of hantavirus infection in humans at a study site in western Montana went up.

Equally important, it remains to be seen if the psyllid can control the knotweed, Stilling says. Shaw agrees: "We are very good at saying what [the psyllid] won't eat … but not whether it will establish," or how effective it will be. Even so, if it reduces the impact of Japanese knotweed by even 1%, it will have paid for its release within a year, Shaw says.

–JENNIFER CARPENTER

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