

BIOLOGICAL CONTROL OF HIMALAYAN BALSAM

Locations	India, United Kingdom
Dates	01/01/2006 - Ongoing

Summary

Himalayan balsam has rapidly become one of the UK's most invasive weed species. A lack of natural enemies allows it to successfully compete with native plants for space, light, nutrients and pollinators, reducing biodiversity and contributing to erosion. Traditional control methods are inadequate. This project involves identifying an insect or plant pathogen that exclusively attacks Himalayan balsam, which can be released into the UK to control the plant while leaving indigenous species intact.

The problem

Himalayan balsam (*Impatiens glandulifera*) has rapidly become one of the UK's most invasive weed species, colonising river banks, waste ground and damp woodlands. It successfully competes with native plant species for space, light, nutrients and pollinators, and excludes other plant growth, thereby reducing native biodiversity.

As an annual, Himalayan balsam dies back in the winter, and where the plant grows in riparian systems this can leave river banks bare of vegetation and liable to erosion. Dead plant material can also enter the river, increasing the risk of flooding. Like most introduced plant species Himalayan balsam arrived in the UK without any of the natural enemies that help keep the plant in check in its native range (the foothills of the Himalayas, India and Pakistan).

Without these natural enemies, Himalayan balsam is able to grow more aggressively and has a greater ability to reproduce, giving it an advantage over native species. Traditional control methods are currently inadequate in controlling Himalayan balsam in the UK. This is often because the plant grows in inaccessible areas or sites of high conservation status where chemical and/or manual control is not an option.

What we are doing

The ultimate aim of the project is to find a co-evolved insect or plant pathogen that exclusively attacks Himalayan Balsam and release it into the UK to control the plant whilst leaving indigenous species intact so that the ecosystems can be restored.

Between 2006 and 2010, surveys were conducted throughout India and Pakistan, the plant's native range, to identify natural enemies that could be considered as biocontrol agents in the introduced range. Many of the natural enemies, both fungal and arthropod species, collected and identified during the surveys were rejected as unsuitable control agents as they were able to attack other species closely related to Himalayan balsam.

One natural enemy, a rust fungus, which was observed causing significant damage on Himalayan balsam, was exported to our quarantine facility in the UK in 2010 to undergo extensive safety testing. The rust, a *Puccinia* species, is an autoecious (completing its entire life cycle on a single species), macrocyclic (five spore staged rust fungus), which infects the stem and leaves of Himalayan balsam throughout the growing season. Watch a photodiary of the 2008 survey.

Results so far

Following a strict internationally recognised testing procedure, we tested the safety of the Himalayan balsam rust against a test plant list comprising 74 species. We also tested an additional 10 varieties of three widely grown ornamental species in the UK. This safety testing showed that the rust is highly specific to Himalayan balsam. We also conducted experiments to determine the life cycle of the rust.

Through this, we were able to prove that all spore stages observed on Himalayan balsam in the native range belong to the same species. We backed up this research with molecular evidence. Interestingly, we found that the rust species is new to science. We, therefore, renamed it following the International Code of Nomenclature (see: *Puccinia komarovii* var. *glanduliferae var. nov.*: a fungal agent for the biological control of Himalayan balsam (*Impatiens glandulifera*)). We compiled all of the scientific research into a dossier (a Pest Risk Analysis (PRA)), which we submitted to UK regulators for consideration, and the European Commission's Standing Committee on Plant Health in Brussels (see: First release of a fungal classical biocontrol agent against an invasive alien weed in Europe: biology of the rust, *Puccinia komarovii* var. *glanduliferae*). Both regulators supported the release of the Himalayan balsam rust in the UK. On the 23 July 2014, the Himalayan balsam rust was approved for release by Defra Ministers making this the first fungal biological control agent to be released against a weed in the European Union.

During 2015-2019, we released the rust at 47 sites across 19 counties in England and Wales. During the early releases, results were variable with low levels of infection observed in the field. Subsequent inoculation experiments conducted under controlled conditions, revealed significant variation in the

susceptibility of plant populations to the rust, with some showing immunity (no infection observed). Therefore, we tested a second strain of the rust from Pakistan which was found to infect a different cohort of Himalayan balsam populations. However, the presence of weed genotypes in the British Isles, not susceptible to either rust strain, requires additional strains to be identified in the native Himalayan range.

To address this, a molecular study, was conducted and identified that Himalayan balsam in the British Isles fall into three groups. This confirms the hypothesis that the species had been introduced into the British Isles on more than one occasion, from multiple locations within the native range. The study also identified key regions in the native range to survey for additional rust strains which are more likely to be fully compatible with UK populations that are currently showing resistance.

The aim is now to collect new strains from the native range to test against unsusceptible populations, while also continuing to release and establish the rust at susceptible sites. We are working with local action groups and landowners to release the rust at susceptible sites across the UK and in 2020 the rust will be released into Scotland for the first time. At fully susceptible field sites, the rust is performing well, adapting to local climatic conditions and spreading from the initial area of release. Good leaf infection is frequently observed in the summer and the rust is able to survive the winter and establish populations in stands of Himalayan balsam the following year.

For further information on CABI's work with Himalayan Balsam, please visit CABI's dedicated Himalayan Balsam page. For an update on our current work, please see the Water Framework Directive document below.

Listen to the podcast:

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