



Department  
for Environment  
Food & Rural Affairs



Llywodraeth Cymru  
Welsh Government



## Progress with Weed Biocontrol Projects

**CABI - UK**

**November 2023**

**Cover image:** Heavy curling damage on leaves of *Reynoutria x bohemica* caused by the psyllid *Aphalara itadori*, Hemel Hempstead, Hertfordshire

## Introduction

Since April 2011, Defra in partnership with the Welsh Government and Natural England has been funding specialist scientists to investigate the scope for biological control (biocontrol) of invasive, non-native aquatic and riverside weeds. Additional financial support for this research has been provided by the Environment Agency, the Canal & River Trust, private water companies, the Ministry of Defence, and a number of Wildlife Trusts and Local Authorities (\* see also footnote for additional funders). Biocontrol has the potential to play an important role in protecting aquatic and riparian habitats where chemical and mechanical control options are impractical or prove to be prohibitively expensive. This will help to meet statutory and policy commitments, both at a UK government level and within the Devolved Administrations (DAs). This control method is already providing sustained and highly successful management of the invasive non-native water fern *Azolla filiculoides* through *Stenopelmus rufinasus*, a weevil native to the Americas which was introduced into the UK together with the weed.

CABI is targeting **Australian swamp stonecrop** (*Crassula helmsii*), **Himalayan balsam** (*Impatiens glandulifera*), **floating pennywort** (*Hydrocotyle ranunculoides*) and **parrot's feather** (*Myriophyllum aquaticum*), and these projects complement our on-going work on the biocontrol of **Japanese knotweed** (*Reynoutria (Fallopia) japonica*). Following a Natural England-funded stakeholder workshop to prioritise new species for biocontrol research, jointly led with CABI, very early-stage research into possible biocontrol approaches for **Tree of Heaven** (*Ailanthus altissima*), **buddleja** (*Buddleja davidii*) and **rhododendron** (*Rhododendron ponticum*) has begun. Natural England is also funding CABI to undertake assessments of natural enemies associated with **Canadian and Nuttall's waterweeds** (*Elodea canadensis*, *E. nuttallii*) and **ice plant** (*Carpobrotus edulis*) regarding their potential as biological control agents. CABI is also mass-rearing and supplying the **water fern weevil**, for early season inoculation of infestations of the weed, to ensure ongoing biocontrol. The release and planting out in the wild of any of these species in the UK is an offence due to their highly invasive nature. This is the 17<sup>th</sup> in a series of annual summary notes on progress made and covers the time frame from April to the end of November 2023.

**Website:** <http://www.invasive-species.org/united-kingdom/>

## Japanese knotweed (*Reynoutria japonica*)

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Whilst the original Kyushu line of the psyllid *Aphalara itadori* showed promise, attempts to achieve long-term establishment and persistent overwintering since 2010 have proved unsuccessful. To address this, better climatically-matched psyllid cultures were collected from Murakami, further north in Japan (Murakami line). These had been observed to cause extensive and severe leaf-curling damage on their knotweed host plants. Host-specificity testing proved that the Murakami line is also a specialist on knotweed species.

Defra approval for release of the Murakami psyllid line was obtained in 2021. Results of lab and 2021-2022 field studies showed the Murakami line prefers Bohemian knotweed (*Reynoutria x bohemica*) over Japanese knotweed. In 2023, the Murakami line was released at a Bohemian knotweed site in April. Field monitoring showed multiple psyllid generations and characteristic curling damage on plants at the Bohemian knotweed site during the season which is very encouraging. International collaboration with Japanese researchers has also been established to search for any psyllids that may cause similar damage preferentially to Japanese knotweed over Bohemian knotweed.



## Floating pennywort (*Hydrocotyle ranunculoides*)



The weevil, *Listronotus elongatus*, was approved as a biocontrol agent against *Hydrocotyle ranunculoides* in September 2021. First releases were initiated in the South East of England in November 2021 and continued throughout 2022, from Sussex to Yorkshire, bringing the total to 13 sites.

Monitoring at all sites in the summer of 2023 confirmed the weevils had successfully overwintered at three sites, in the South, South East and Central regions of the country. At these sites, the weevils were continuing to spread over distances of up to 150m, causing stunting and collapse of floating pennywort mats. Supplementary weevil releases were made at nine pre-existing sites where weevil activity could not be confirmed or where releases in 2022 may have been compromised by high flows, prolonged frosts and/or unintentional removal. Weevils were also released at a further six new sites, including two in Kent.

In autumn 2023, monitoring of supplemented and new sites confirmed successful development, with new generations of weevils emerging across the country, including sites in Yorkshire and Greater Manchester. Building multi-generational populations will hopefully provide increased resilience and facilitate more widespread weevil overwintering and continued impact in following years. Monitoring will continue in 2024, across all 19 sites, to assess weevil survival/establishment and field data analysis will also contribute to overall predictions of site suitability/ weevil efficacy across the country.

## Himalayan balsam (*Impatiens glandulifera*)

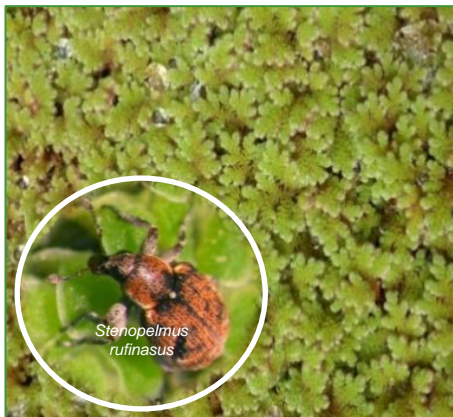


A strain of the Himalayan balsam rust fungus *Puccinia komarovii* var. *glanduliferae* from India, was approved for release into the wild in the UK in July 2014. However, due to the presence of rust-resistant populations, an additional rust strain from Pakistan, infecting a different subset of Himalayan balsam populations, was approved for release in 2017. The rust has been released widely in England and Wales and, since 2020, also in Scotland.

Pre-release susceptibility testing, to ensure the most virulent and pathogenic strain is released at each site, and an improved release strategy collaborating with Local Action Groups across the country, has significantly increased infection levels in the field. The results of the field releases are encouraging; the rust has established at sites with fully susceptible plant populations and overwinters successfully with good levels of leaf infection observed during the following growing season. Natural spread by wind can exceed 500 metres.

Rust releases continue at compatible sites, however, in order to counter the presence of resistant populations and achieve full control, additional rust strains are required. Key regions in the native range harbouring strains more likely to be fully compatible with UK populations were identified through a molecular analysis. Collaborators in Pakistan surveyed these areas from 2021 to 2023 and exported rust-infected plant material from four sites to CABI. To date one rust strain collected from the Astore District, Gilgit-Baltistan, Pakistan has been successfully established under quarantine conditions. The pathogenicity and virulence of this new strain towards UK Himalayan balsam populations is under assessment. If found to infect a different cohort of populations, host-range testing against a number of closely related *Impatiens* species will be conducted; early results indicate that the host range of the new strain matches that of the two rust strains already released. Subsequently, approval for release from quarantine will be sought and, where possible, the new rust strain will be released at field sites in the UK.

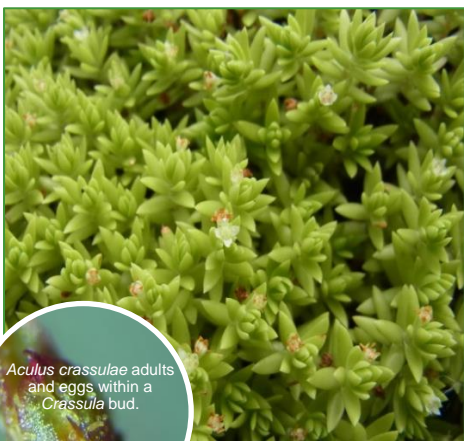
## Water fern (*Azolla filiculoides*)



Despite a relatively cold winter, pre-orders for weevils in 2023 were received at a steady rate as new or persistent *Azolla* infestations were observed and orders remained regular over the summer and continued late into the season. *Stenopelmus rufinasus* feeds specifically on *Azolla* and in high densities can cause local eradication of the weed. In addition, *Azolla* infestations are frequently brought under effective control by naturalised populations of the weevil, particularly in regions that have recently received weevil introductions, demonstrating the underlying control exerted by this effective agent. By targeting *Azolla* outbreaks in a timely manner, it is possible to limit impacts and preserve the biodiversity of freshwater ecosystems. CABI recently published an assessment of the value of *Azolla* biocontrol by *S. rufinasus*, which was estimated to be worth up to £16.8 million annually in management cost savings (<https://doi.org/10.1186/s43170-022-00136-0>)

Website: [www.azollacontrol.com](http://www.azollacontrol.com)

## Australian swamp stonecrop (*Crassula helmsii*)



The gall-forming mite, *Aculus crassulae* (Eriophyidae) was approved as a biocontrol agent against *Crassula helmsii* in August 2018. Field release trials with the mite were initiated in September 2018 and mites have now been released across England and Wales with the support of further sponsors. Mites have successfully overwintered at several field sites in southern England and Wales where conditions are suitable and have been recorded spreading some distance from field plots. Efforts are now needed to increase the population density of mites at release sites to enable establishment and subsequently, impact.

Unfortunately, severe winter conditions in 2022/23 badly affected mite populations in the spring and as a result mites were re-released at nine of the 2022 sites in summer 2023. Mites were also released at a further two new sites in North Wales. At the release sites, mite populations were starting to recover by the end of the summer and were recorded infesting plants within and close to release plots, the number of mite-infested plants has generally increased over the course of the summer. Good progress has been made with *A. crassulae* but some *C. helmsii* infestations are unsuitable and where water levels are too high or inconsistent, may not meet the habitat requirements of the mite. Thus, options to carry out surveys to find additional natural enemies in the native range that could complement the mite are being explored.

## Parrot's feather (*Myriophyllum aquaticum*)

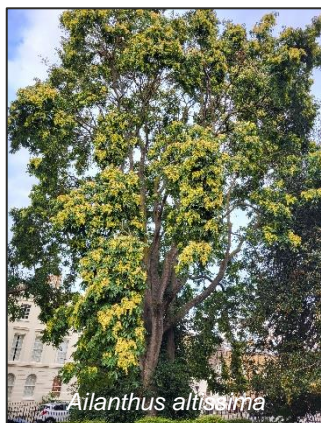


Following an initial feasibility study to assess its potential as a biocontrol target in 2021, natural enemies of parrot's feather are now under laboratory assessment for use in the UK. A leaf-feeding beetle, *Lysathia* sp., which has previously been released in South Africa and provides good control of parrot's feather there, was imported from South Africa in September 2021. Safety testing with this beetle continues in CABI's quarantine laboratories. The quarantine assessments, conducted in coordination with CABI's Swiss centre who also have a *Lysathia* sp. culture, are being undertaken to establish the beetle's potential host range in the field. The UK research is focused on biocontrol potential for the UK, while the Swiss research is for North America. Collaboration has been established with the Fundación para el Estudio de Especies Invasivas (FuEDEI) in Argentina, where parrot's feather originates. Scientists at FuEDEI have recently investigated the stem-mining weevil *Listronotus marginicollis* which has potential as a biological control agent against parrot's feather and CABI has initiated the permit and import process to obtain a culture of the weevil from FuEDEI in 2023-24 which was delayed by drought in 2022-23.



## New targets - Tree of Heaven (*Ailanthus altissima*), Buddleja (*Buddleja davidii*), Rhododendron (*Rhododendron ponticum*)

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Work on these three new target species commenced in 2022. Tree of heaven is already the target of biological control programmes in North America as well as in Austria, with work focussing on a mite *Aculus taihangensis* which can cause severe damage to tree of heaven seedlings in continental Europe. In 2023, surveys searching for the mite and other damaging natural enemies have been undertaken. For buddleja, the feasibility of a classical biocontrol approach was outlined in a scientific dossier, compiling literature and scientific research from countries such as New Zealand, where buddleja is already the target of a successful biocontrol campaign. An online consultation will be launched in 2024 to explore public and stakeholder attitudes to the concept. Given the ornamental value of buddleja a targeted approach using a mycoherbicide as a cut-stump treatment is pursued in parallel and the assessment of selected species of native wood-rotting fungi, with a specific focus on *Chondrostereum purpureum*, has started. The same control strategy is to be pursued for *R. ponticum*, given the ornamental value of other rhododendron species and hybrids in the UK, with field survey work focussing on sourcing native wood-rotting fungi associated with the invasive shrub for further evaluation.

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### Contact

**CABI**, Bakeham Lane, Egham, Surrey TW20 9TY, UK, **Tel:** +44(0) 1491829049, **Email:** [m.seier@cabi.org](mailto:m.seier@cabi.org)

*\*Footnote: Prior to 2011, funding for this research has also been provided by the Scottish Government, predecessor bodies of the Welsh Government, Network Rail, Cornwall Council, the Regional Development Agency of South West England*