



Department
for Environment
Food & Rural Affairs



Llywodraeth Cymru
Welsh Government



Progress with Weed Biocontrol Projects

CABI - UK

March 2024

Cover image: *Listronotus marginicollis* adult ex Argentina on *Myriophyllum aquaticum*

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 rufinusus*, 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 in 2022, 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 18th in a series of annual summary notes on progress made and covers the time frame from December 2023 to the end of March 2024.

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

*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 Southwest England

Japanese knotweed (*Reynoutria japonica*)



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 in Japan. Host-specificity testing confirmed 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 to prefer the hybrid Bohemian knotweed (*Reynoutria x bohemica*) over Japanese knotweed. In April 2023, the Murakami line was released at a Bohemian knotweed site and has been monitored closely. Multiple psyllid generations and characteristic curling damage on plants were observed throughout the season which is very encouraging. Impact studies also showed that the psyllids inhibited the growth of Bohemian knotweed plants. Japanese collaborators have found knotweed populations exhibiting leaf-curling damage caused by the psyllids in the northern part of Japan; however, the host plants were identified as giant knotweed (*Reynoutria sachalinensis*). A search for a psyllid line that thrives and causes similar damage on the main target knotweed species is planned.

Floating pennywort (*Hydrocotyle ranunculoides*)



In September 2021, the weevil *Listronotus elongatus* was granted approval for release as a biocontrol agent for *Hydrocotyle ranunculoides*. Field trials were initiated in November 2021 and the weevils have since been released at 19 sites across England. In 2023, successful overwintering was recorded at sites in the South, Southeast and the Midlands. Impact and spread throughout the summer and autumn were found to be significant, particularly at southern sites.

In early 2024, with warmer winter temperatures than averaged in previous years, floating pennywort has persisted at many sites, albeit much reduced. The heavy rains and high river flows are likely to have increased plant movement in some of the more dynamic systems. Monitoring plant persistence across sites in February and March provides a useful baseline year on year and although weevil activity is not usually detectable at this early stage, evidence of previous mining activity was found at several of the more sheltered and static sites. All sites will be revisited in early summer to assess weevil survival and supplementary releases made, as needed, to maximise the chances of establishment. A preliminary study evaluating the potential of remote sensing technology has been found to hold potential as a complementary tool for monitoring the weevil's spread and impact.



Himalayan balsam (*Impatiens glandulifera*)

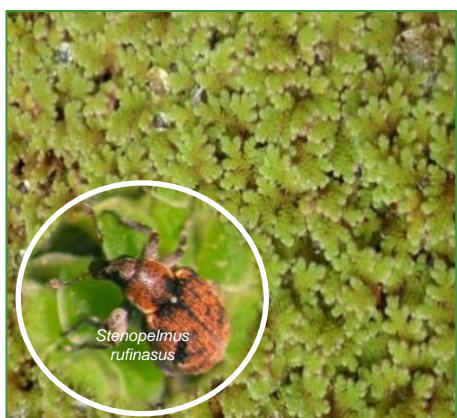


The Himalayan balsam rust fungus *Puccinia komarovii* var. *glanduliferae* was approved for release into the wild in the UK in July 2014 and to date, two strains, one from India and one from Pakistan, have been released. These strains were found to infect different subsets of Himalayan balsam populations and thus, plants from potential field sites undergo pre-release susceptibility testing, to ensure the most virulent and pathogenic strain is released at each site.

Using an improved release strategy collaborating with Local Action Groups, the rust has been released widely across England and Wales and, since 2020, in Scotland. 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 has been seen to exceed 500 m.

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 those resistant UK populations were identified through a molecular analysis. Collaborators in Pakistan surveyed these areas from 2021-2023 and exported rust-infected plant material from four sites to CABI. 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 is currently under assessment. If found to infect a different cohort of Himalayan balsam 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 is the same as that of the two rust strains already released. Approval for release from quarantine will only be sought if a sufficient number of rust resistant Himalayan balsam populations are infected.

Water fern (*Azolla filiculoides*)



A relatively mild winter has given rise to extensive pre-orders for weevils into 2024 as new or persistent *Azolla* infestations are observed. *Azolla* can be significantly knocked by prolonged sub-zero conditions but seems to have survived the winter at numerous sites. *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.

Website: 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.



Aculus crassulae adults and eggs within a *Crassula* bud.

Unfortunately, severe winter conditions in 2022/23 badly affected mite populations in the spring. Mites were released at 11 sites in 2023 and by the end of the summer mite populations were starting to recover and were recorded infesting plants within and close to release plots. These sites will be revisited in spring 2024 to assess winter survival. Although good progress has been made with *A. crassulae*, some *C. helmsii* infestations are unsuitable and, where water levels are too high or inconsistent, may not meet the habitat requirements of the mite. Therefore, 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*)



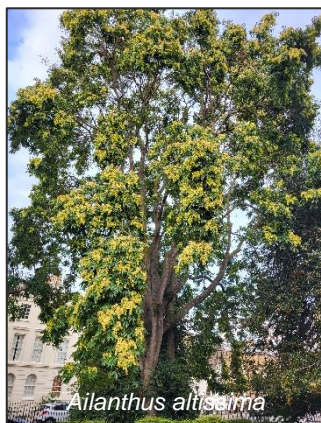
Lysathia sp.

Listronotus marginicollis

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, 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 sourced a promising stem-mining weevil *Listronotus marginicollis* which has potential as a biological control agent against parrot's feather, and following delays caused by drought have recently shipped a first culture to CABI for host-range assessment in quarantine.

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



Early-stage research on these three potential 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 the mite *Aculus taihangensis* which can cause severe damage to seedlings in continental Europe. In 2023, surveys searching for the mite and other damaging natural enemies already present in the UK commenced, but to date no promising agent has been observed in the field. 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 to be launched in spring 2024 will explore public and stakeholder attitudes to the concept. Given the ornamental value of buddleja, the assessment of a targeted approach using a mycoherbicide as a cut-stump treatment is pursued in parallel. The same control strategy is to be assessed for *R. ponticum* due to the presence of ornamental rhododendron species and hybrids in the UK. Field survey work undertaken from 2022 to 2023 has sourced a number of UK native wood-rotting fungi associated with the invasive shrubs and inoculation studies have commenced to evaluate selected fungal species further, with a specific focus on *Chondrostereum purpureum*.

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