Progress with Weed Biocontrol Projects

CABI in the UK

May 2017

Cover image: Overwintered psyllid on Japanese knotweed, UK

Introduction

Since April 2011, Defra has been funding specialist scientists to investigate the scope for biological control of invasive, non-native aquatic and riverside weeds. The technique 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, and thus to help meet requirements of the EU Water Framework Directive.

We are targeting **Australian swamp stonecrop** (*Crassula helmsii*), **Himalayan balsam** (*Impatiens glandulifera*) and **floating pennywort** (*Hydrocotyle ranunculoides)*. These projects complement CABI's on-going work on the biocontrol of **Japanese knotweed** (*Fallopia japonica*) and **water fern** (*Azolla filiculoides)*. This is the seventh in a series of annual summary notes on progress made and covers the time frame to the end of April 2017.

Japanese knotweed (*Fallopia japonica*)

Previous mass releases of the psyllid (2010-2013) had limited success in establishing large populations at eight isolated release sites. The initial focus of the work was to prove that the psyllid has no untoward effects on native flora and fauna, and to date there has been no observable negative impact on native species. In 2014, a replicated caged field trial revealed the safety of the agent for native invertebrates if present in high densities. The evidence was reviewed and a new licence was issued permitting the release of psyllids at riparian sites thought to offer better conditions for establishment. During the summers of 2015 and 2016 an intensive release and monitoring campaign was conducted in collaboration with Local Action Groups and Local Authorities at 18 sites (9 in 2015) across England and Wales. Adults were found in all sites with lower abundances towards the end of the season. Early establishment (nymph stage) was observed at most of sites together with no significant impact in the recipient environment. During spring 2016 overwintering was only confirmed in one southern site. For the first time, releases using winter morph adults and a new psyllid strain (higher field adaptability) were carried out in autumn 2016. Surveys undertaken in spring 2017 have confirmed overwintering survival at sites across the UK.

The potential of the leaf-spot fungus (*Mycosphaerella polygoni-cuspidati*) has been extensively studied, but is currently not taken further for classical biocontrol due to its ability to cause restricted disease symptoms on a couple of non-target plant species under quarantine greenhouse conditions. However, as the pathogen needs two different mating types to complete its life cycle a mycelial formulation based on one mating type only could be used as a mycoherbicide. To protect this idea both UK and International patent applications have been submitted and published in the name of the Secretary of State. Initial experiments for "proof of concept" are showing that the pathogen retains its viability and pathogenicity towards Japanese knotweed during long-term storage in liquid nitrogen and when applied as a mycelial spray.

Water fern (*Azolla filiculoides*)

A mild winter allowed Azolla to survive unscathed into 2016 with the plant becoming widespread and abundant in England and Wales. The extent of Azolla infestation resulted in high early demand for the Azolla biocontrol weevil, *Stenopelmus rufinasus*, which is mass reared at CABI (www.azollacontrol.com). This small weevil feeds directly on Azolla and in high densities can cause local eradication of the plant. The weevils are specific to Azolla and after clearing a site of the weed the adults will either die out or disperse to seek out more.

Weevil shipments began at the start of summer and record orders necessitated scaling-up of weevil-rearing activities at CABI, with more than 50,000 weevils hand collected and shipped by the end of the season. By targeting Azolla outbreaks in a timely manner it is possible to limit the extent of infestations and redistribution of the weed, bringing about economic savings, reducing leisure impacts and preserving the biodiversity of freshwater ecosystems

Floating pennywort (*Hydrocotyle ranunculoides*)

The semi-aquatic weevil, *Listronotus elongatus* (Curculionidae), was prioritised as the biocontrol agent for the control of *Hydrocotyle ranunculoides*. Host range testing against 62 species of carefully selected plants have shown that the weevil has a significant feeding and oviposition preference for floating pennywort and is incredibly damaging. Preliminary research studies into developmental thresholds of the weevil, as well as the relationship betweeen air and water temperature, suggested it would be able to survive and establish under UK climatic conditions. The final Pest Risk Assessment (PRA) detailing all the research conducted to date was submitted to Defra for review and peer evaluation. A few UK native species and 3 species of European relevance remain to be fully tested but as the majority are neither closely related nor likely to overlap with the target's habitat, no non target impacts are anticipated. Tests will be completed prior to any release decision being made. Depending on the outcome of the PRA review and the successful application for a release licence, the weevil may be used for control of floating pennywort in the wild.

Himalayan balsam (*Impatiens glandulifera*)

In 2014 CABI completed the host-range testing of the Himalayan balsam rust *Puccinia komarovii* var. *glanduliferae* from India, which proved the rust is a true specialist on its host. In total, 75 plant species of importance to Europe were tested including native, ornamental and economically important plant species. A Pest Risk Assessment (PRA) which fully detailed the research conducted on the host range, life-cycle and ecology of the rust was submitted to Defra in 2014. The PRA underwent further evaluation by the European Commission's Standing Committee on Plant Health and following their feedback Ministers approved the release of the rust on the 27th July 2014. The rust was released at 3 sites in 2014, and in 2015, at 25 sites in 10 counties across England and South Wales.The rust was found to spread on to adjacent field plants, and the overwintering spore stage subsequently developed at many sites, but the rust did not over winter. In 2016 work focussed on establishing the rust at fewer sites, and develping a robust release strategy based on emerging knowledge and studies.

Infection in the field was very high at some sites in 2016, and in April 2017 natural infection of seedlings was observed at a two field sites in the South of England. Although, early days, it is encouraging that the rust was able to overwinter naturally in the field, and provides evidence that the rust will establish in the UK. The spread and impact of the rust will be monitored over the next few years.

Australian swamp stonecrop (*Crassula helmsii*)

The Australian gall forming mite, *Aculus* sp. (Eriophyidae) which is new to science, has been prioritised as the biocontrol agent for the control of *Crassula helmsii*. Host range testing is now complete and studies have shown that the mite has the potential to survive and establish under UK climatic conditions. Results of the host range testing have demonstrated that the mite only infects and damages its host, *C. helmsii* while other important plant species in the UK are not affected by the presence of the mite. A Pest Risk Assessment (PRA) detailing the research conducted to date on the mite was submitted to Defra following the completion of studies on the establishment potential of the mite. If the PRA is approved by the regulators and the application for a release licence is succcessful, the mite may be released in trials in late 2017, or spring 2018.

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