Biologische bestrijding van invasieve onkruiden; wereldwijd in gebruik

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CABI is a not-for-profit international organization that improves people’s lives by providing information and applying scientific expertise to solve problems in agriculture and the environment.
Invasive species threaten biodiversity and degrade ecosystem services: they are the 2nd most important cause of species extinction.

Invasives cause significant losses in agriculture, threatening the food security of millions.

Due to weed invasions, pastoralists are losing grazing land and are driven into extreme poverty.

Various invasive species have detrimental health impacts (e.g. Prosopis in Africa).

Land degradation and crowding out of native species drives conflict.
Estimated economic costs

- Loss to the world economy as a result of invasive non-native species is estimated at 5% of annual production
- Global costs estimated at > $1.4 trillion

- USA $134 billion/year
- Europe €12.7 billion/year
- UK £1.7 billion/year
- NL €1.3 – 2.2 billion/year
Management strategies for invasive species

Prevent

- Too late

Control

- Best option

Eradicate

- Too Great

Chemical

Restricted by legislation and environmental impact, resistance

Biological

BEST OPTION
Most cost effective and sustainable

Mechanical

Difficult, ineffective, destructive and costly, can be counterproductive
Biological Control methods

**Conservation** - Protection and maintenance of existing natural enemies

**Inundative** - the “Mycoherbicide Approach” using large numbers (often native species) and repeated application

**Classical** - Uses co-evolved, and highly specific natural enemies from the area of origin of the plant to provide self-sustaining control, often after a single or few releases (non-commercial)
Advantages of weed CBC

- Based on scientifically sound principles and protocols
- 100+ year history
- Sustainable
- Cost effective
- Environmentally benign
- Efficacious
- Good safety record
Weed Classical Biological Control

- A century of research, over 1300 releases globally
- Biocontrol agents significantly reduce target weed size, mass, reproduction and density
- Native plant diversity increased significantly after biocontrol
- International code of conduct FAO and IPPC
- Non-target effects are predictable by the vigorous safety testing (< 5% found feeding on non-target plants, which predicted or predictable with current approaches)
- Cost-benefit ratio of biocontrol projects small to negligible (1:2,3 – 1:4000) (Culliney et al. 2005; De Lange & Van Wilgen 2010)
Japanese knotweed in UK ("Japanse duizendknoop")

- Costs > £150 mln p.a.
- Damages buildings, infrastructure, etc.
- Mortgages refused
- Impacts biodiversity
- One of the top 100 invasive species (IUCN)
Japanese knotweed

First weed CBC in Europe

- Six years of research in UK
  - numerous surveys to Japan
  - agent selection
  - host range testing (89 plant species)
  - risk assessment
- Host specific psyllid - *Aphalara itadori*
- First release in 2010
- 5-yr monitoring programme in place
- Cost of research < 0.1% of damage
- Other European countries may follow
Impact of *A. itadori* on JKW after 4 weeks

+ psyllids

control
Japanese knotweed in the Netherlands

- 1st appearance outside Japan was in Leiden in the Netherlands in Philipp von Siebold’s garden

- Potential for biological control:
  1. the natural enemy *Aphalara itadori*
  2. *Mycosphaerella* leaf-spot fungus
Potential for application in the Netherlands

- NVWA selected additional non-target test plant species including native species and others of horticultural importance
- **Testing in UK**

- Results confirm the psyllid’s high specificity to knotweeds
- None of the additional non-target species supported any development of the psyllid, confirming their poor host potential
- Susceptibility to leaf-spot demonstrated to varying degrees
- Next step PRA for aphalara and Europe-wide consultation
**Another target: Azolla filiculoides**

(“groot kroosvaren”)

- Azolla was introduced from US as ornamental
- *Stenopelmus rufinasus* got introduced alongside
- “Untypical” example of classical biological control
**Stenopelmus rufinasus**

- Native to southern and western USA
- *Azolla* specialist: Larval stage most damaging
- First identified in Britain in 1921, in the Netherlands in 1922
- Defra: ‘Ordinarily Resident’
- [http://www.azollaccontrol.com/](http://www.azollaccontrol.com/)
Azolla control in the Netherlands

- STOWA funded pilot for NL
- CABI undertook literature review and produced full Pest Risk Assessment (*ontheffing flora en fauna*)
- Staff of *Hoogheemraadschap Schieland en de Krimpenerwaard* made study visit to CABI in UK
- Weevil rearing and establishment pilot done at HHSK
- Enhanced by RINSE cross border project [http://www.rinse-europe.eu/](http://www.rinse-europe.eu/)
Other opportunities for the Netherlands

Himalayan Balsam ("reuzenbalsemien")
Impatiens spp.

- Nine surveys conducted to the plant’s native range
- Numerous natural enemies collected and identified
- Based on field observations and laboratory studies most organisms have been rejected
- One organism was selected for further work - a plant pathogen
**Puccinia komarovii**

- Autoecious rust fungus
- Attacks the stem and leaves of the plant
- The test plant list evaluated with no non-target symptoms
- Rust fungi have been used worldwide to control invasive plant species:
  - *Lantana camara* – India
  - *Mikania micrantha* - India, PNG
  - *Cryptostegia grandiflora* - Australia
Is there potential for the Netherlands?

- Research since 2006 with highly specific rust fungus *Puccinia komarovii*
- PRA reviewed by UK licensing body and feedback positive for release (in 2014)
  - Opportunity for susceptibility testing of Dutch *I. glandulifera* and priority test plants and PRA for the Netherlands
  - Potential rapid delivery of biocontrol in the Netherlands
Conclusions

- Classical biological control is tried and tested and environmentally sound

- CBC agents for weeds are exotic organisms

- CABI has applied regulatory pathway with the knotweed psyllid in UK (and is currently applying this in the Netherlands)

- Subject to regulatory approval there is potential for delivery of these solutions in the Netherlands