



# ➔ Japanese knotweed biocontrol tests Europe's perceptions

Dick Shaw & Team

**100**years  
of scientific endeavour

www.cabi.org  
KNOWLEDGE FOR LIFE

# Outline

Perceptions of IAS in Europe

The knotweed story

- The plant

- Natural enemies

- Research

- Licensing

- Progress to date

The future of weed biocontrol in Europe

# The EU

Heaven is where the police are British, the chefs French, the mechanics German, the lovers Italian, and it is all organized by the Swiss.

*Hell is where the chefs are British, the mechanics French, the lovers Swiss, the police German, and it is all organized by the Italians.*



## Reasons for arrival

Nostalgia

Attraction to riches

Improving the ecosystem

**Neophilia**

## Public attitudes

Not a big issue

Someone else's problem

# Public Awareness Survey (GB NNS Board)

- 42% were unable to give any examples of INNS
- 4 species were mentioned most frequently:

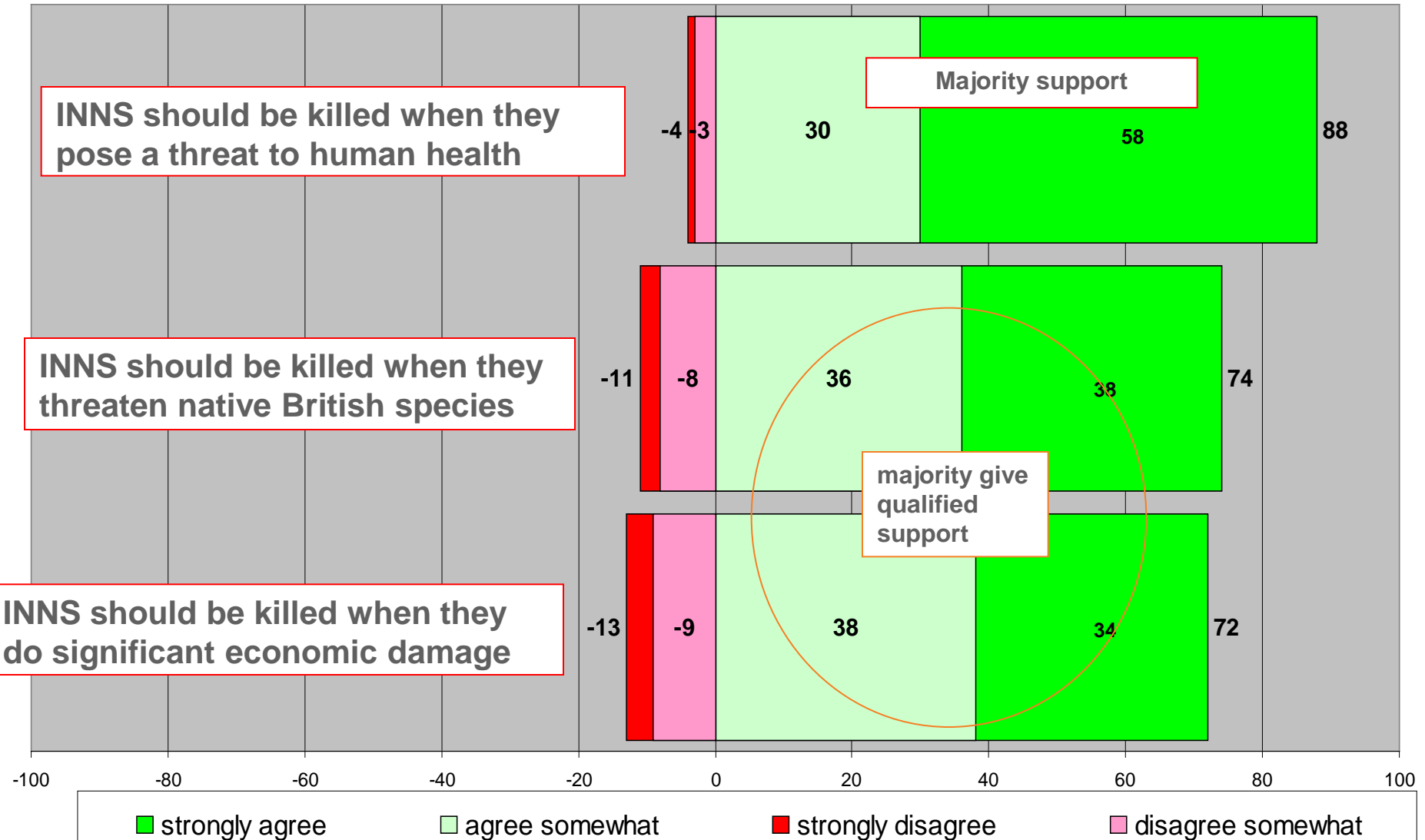
American grey squirrel(37%)

Japanese knotweed  
(19%)

signal/American crayfish  
(10%)

American mink  
(10%)

# The nuclear option





- Very few are banned in EU
- Attempts are resisted strongly
- Single market causes problems



Photo J.McFarlane

# Historically perceived as the source of IAS



## Weed BCA history

Country	Recipient	Source
Austria	0	48
Finland	0	5
France	0	111
Germany	0	46
Greece	0	29
Italy	0	71
Portugal	0	18
Spain	0	9
Sweden	0	3
UK	1	41
Total	1	381

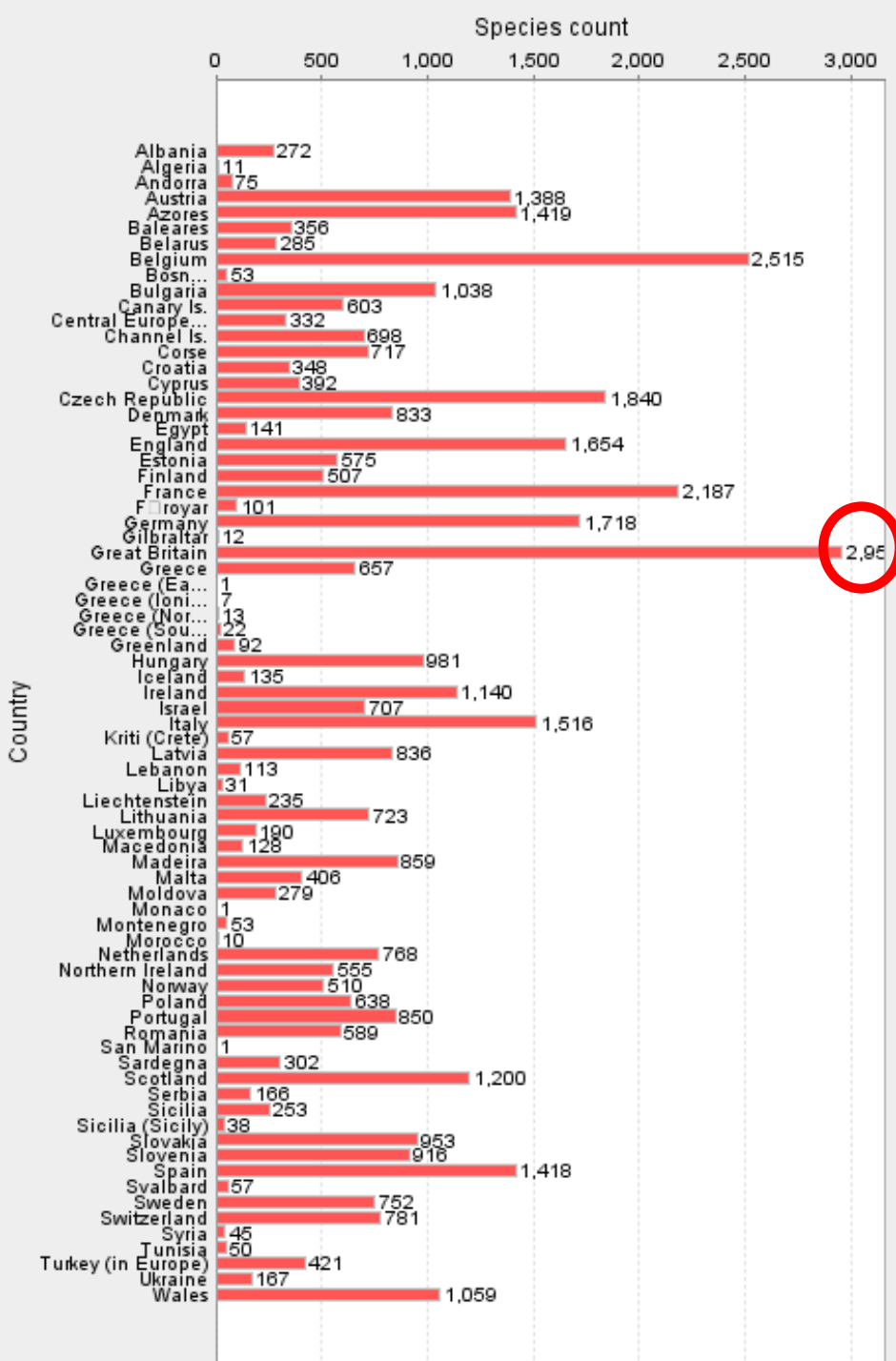




*Ambrosia artemisiifolia* (above)

*Lysochiton americanus* (right)





# GB leads Europe in number of IAS

## but also in doing something about it

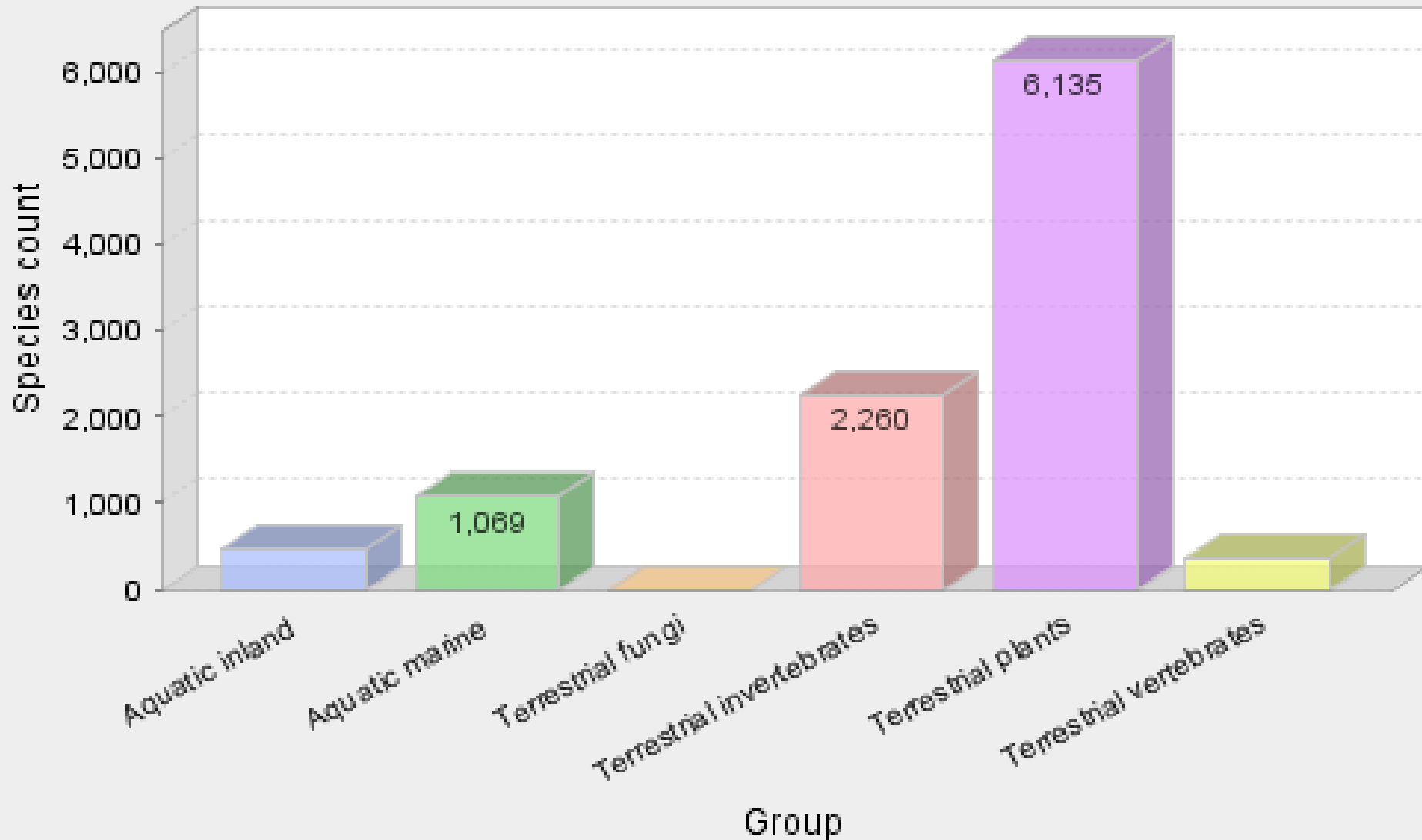
[www.nonnativespecies.org](http://www.nonnativespecies.org)

The Invasive Non-Native Species Framework Strategy for Great Britain



Protecting our natural heritage from invasive species

# Plants are often the worst invaders



# Pick your target well

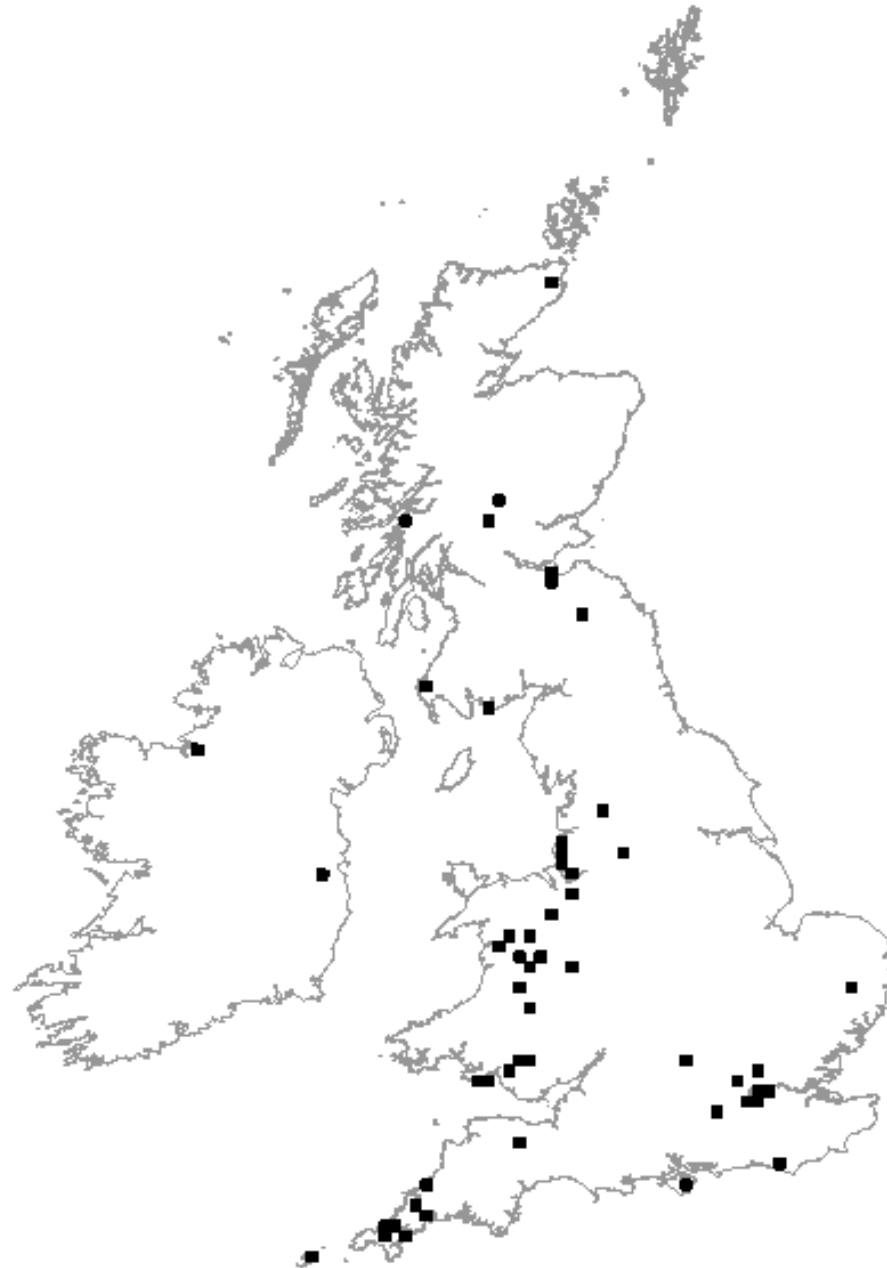


Sheppard, A.W., Shaw, R.H. & Sforza, R. (2006) Classical biological control of European exotic environmental weeds: The top 20 potential targets and the constraints. *Weed Research* 46 pp93-118

1900



1940



1970



2006







- It has no friends
- It is largely clonal
  
- The economic impact is massive
  - \$100,000 for 1m<sup>2</sup>
  - \$225 million p.a to GB
  - \$2.3 billion to control
  
- Large environmental impact: biodiversity/flooding
- “Inextirpable” – hard to kill/control

# Regeneration capacity



Photos J.McFarlane



Photo J.McFarlane

# Killing the green monster

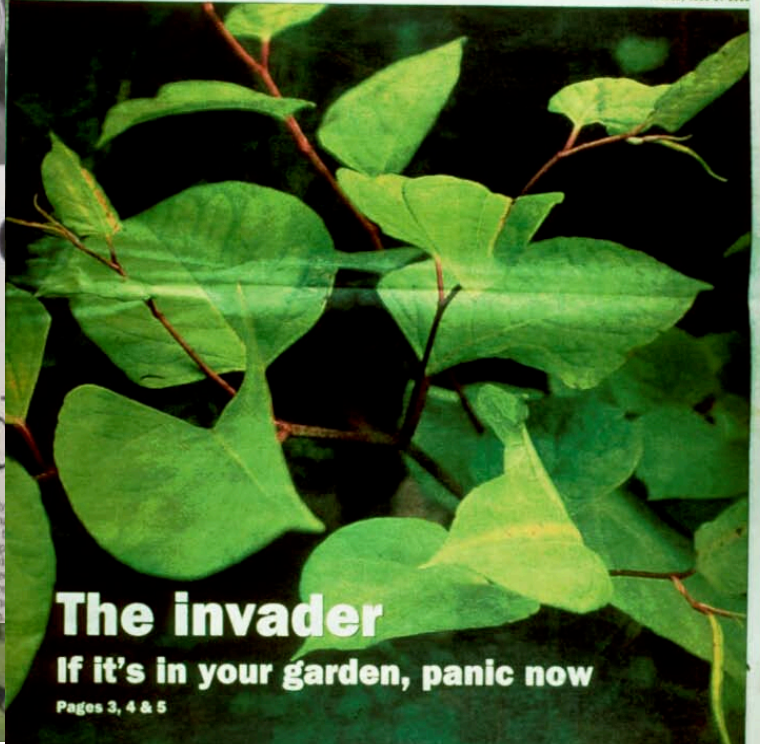
10 LAW 20 SEPTEMBER 2005 THE TIMES  
Knotweed: a green menace



It's high time for biological warfare

# "Largest Female on earth set to conquer rural Britain"

**THE TIMES** 2  
Best for health  
Secrets of pain; plus Dr Jane Collins on children's eating disorders Page 50-51  
David Bowie makes a comeback  
Pages 6 & 7  
Monday June 27 2005



## The invader

If it's in your garden, panic now

Pages 3, 4 & 5

Britain's gardeners are living in fear of an evil stalker

# The Weed from Hell

By ANN TRENEMA

**T**HE graveyard of Caersalem Newydd's Baptist chapel looks like a forest—two full acres of solid, swaying greenery. Only four stone columns rising up like exclamation marks suggest otherwise. Growing densely on either side of us as we hack a path is Japanese knotweed, its bamboo-like stems bursting through the ground around and through the graves, toppling the headstones, disturbing the dead. This could be a horror movie.

"It knocks over walls and grows straight through Tarmac," says Sean Hathaway. "I've seen gardens where it's growing right up to the house: people can't open their back doors."



INTO COMBAT: Beetles like this will be used to fight the spread of Japanese knotweed

# Beetles go into battle in War of Superweeds

**BRITAIN** may use biological warfare to tame a Triffid-like weed which can grow through concrete.

The Environment Agency is considering plans to bring beetles and fungus halfway round the world to take on Japanese knotweed.

The silent plant, which...

for repairing the damage the plant causes and for trying to control it runs into tens of millions of pounds every year.

Swansea City Council has been forced to appoint a knotweed offi...

the knotweed is eaten by a range of beetles and fungi, a result is a small plant in harmony with other p...

Knotweed grows rapidly to a height of about 12 feet in weeks. Its roots also sprout 15 feet underground in any direction.

BY JOHN INGHAM  
ENVIRONMENT EDITOR



# A consortium of Sponsors came together in 2003 to sponsor the programme

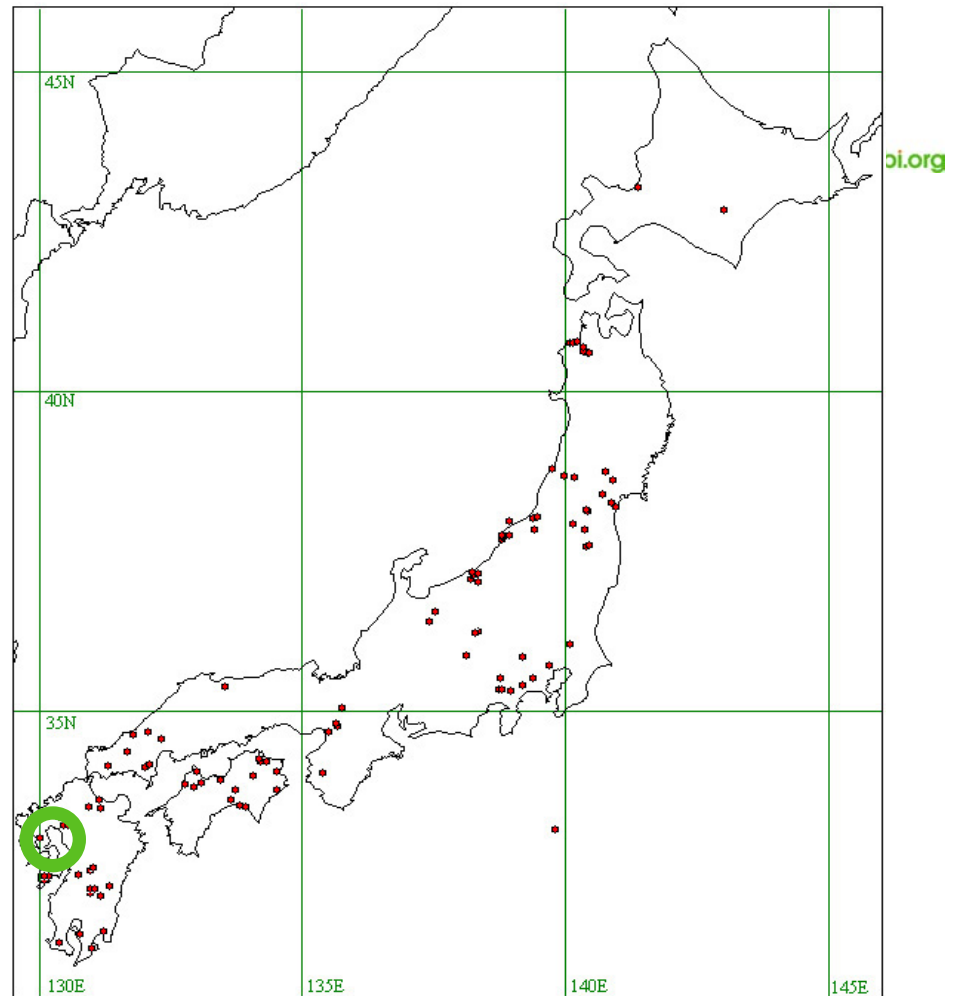




## Canadian and US funding and support

See Grevstad et al poster for NA data

# Molecular tools

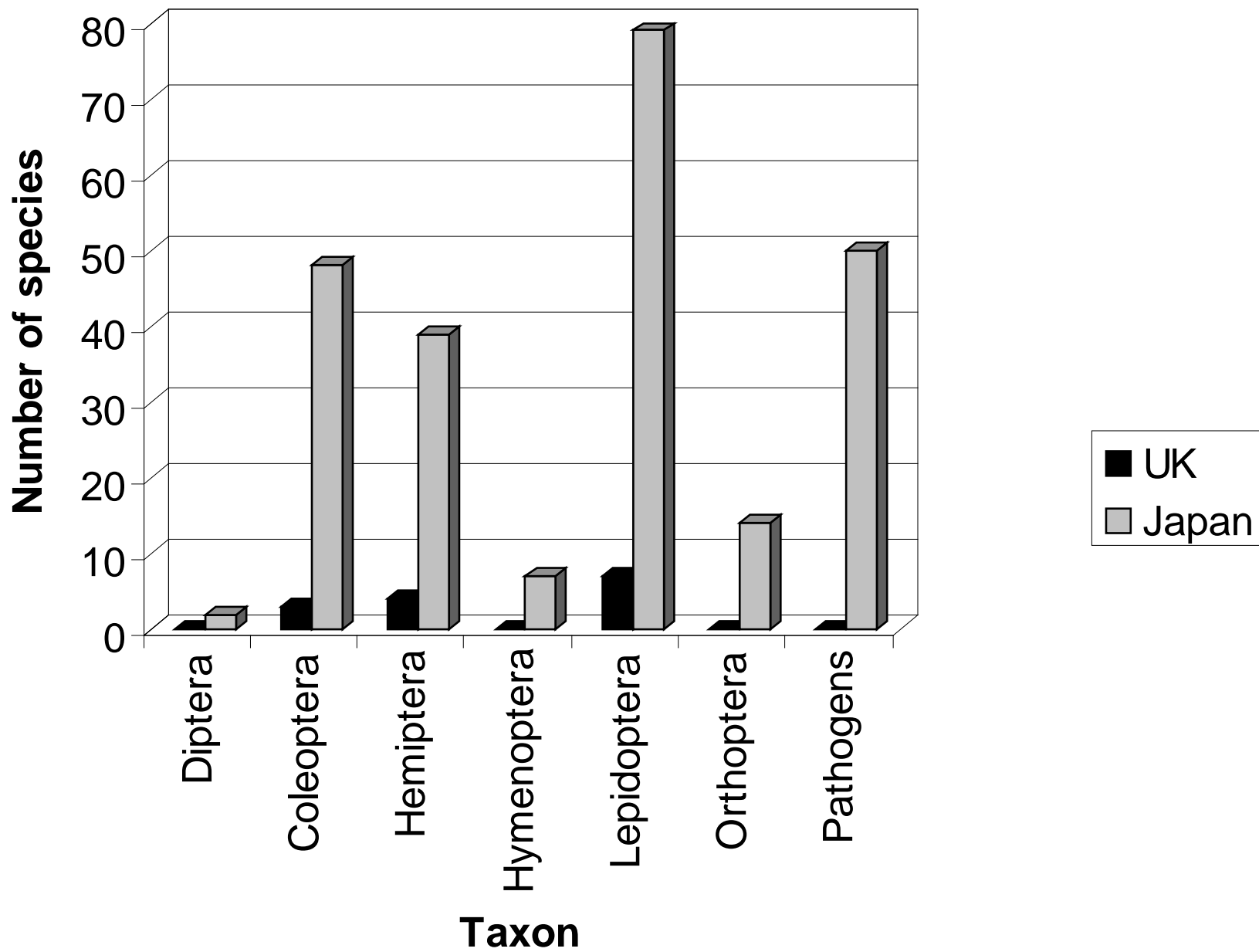


**Leicester University analysed  
>340 knotweed samples.  
Showed 4 clades in Japan  
Closest match from Nagasaki**

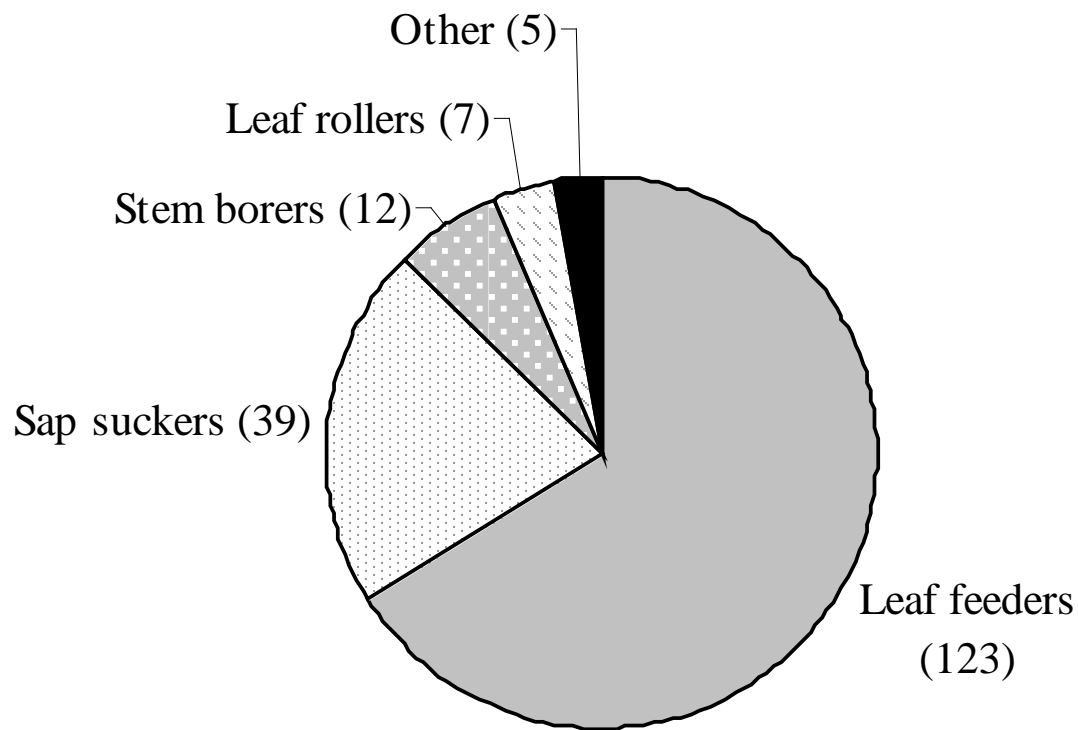




**The Japanese  
team at Institute  
for Biological  
Control in Kyushu  
University -  
Fukuoka**



## Many insects feeding on most parts



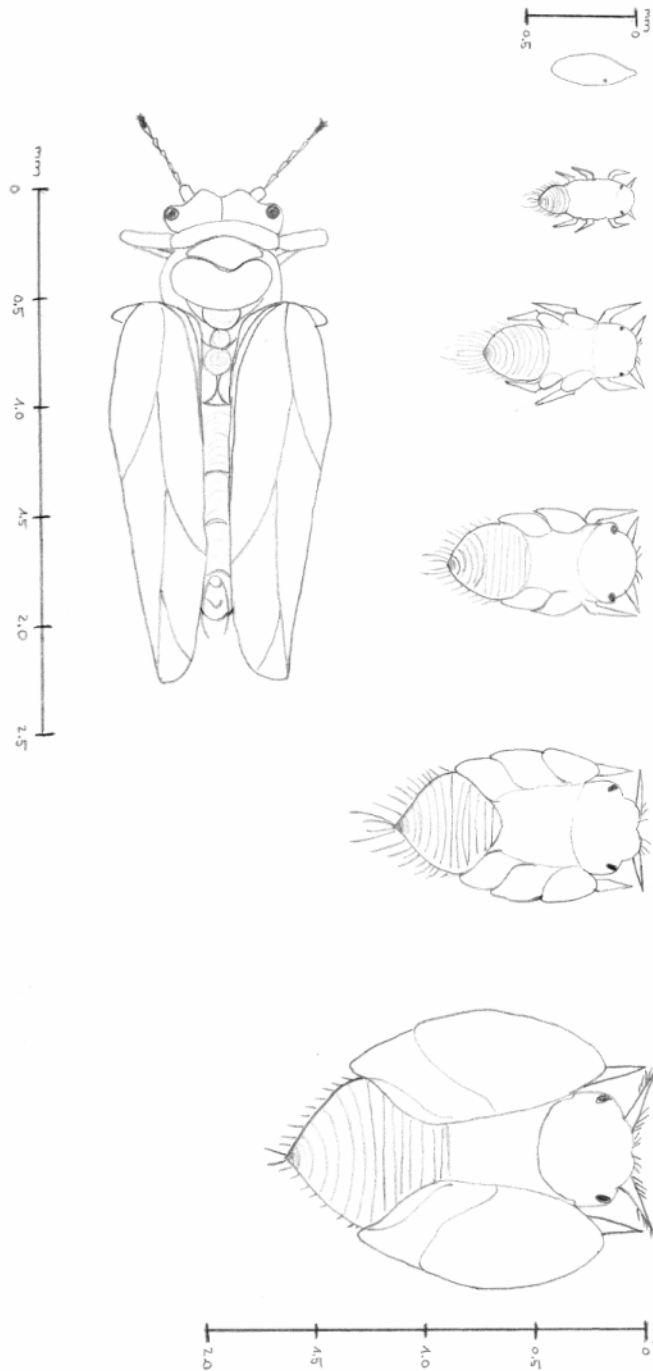
186 species of phytophagous arthropod recorded from Japanese knotweed in Japan.



*Aphalara itadori*







## ■ Detailed life cycle studies

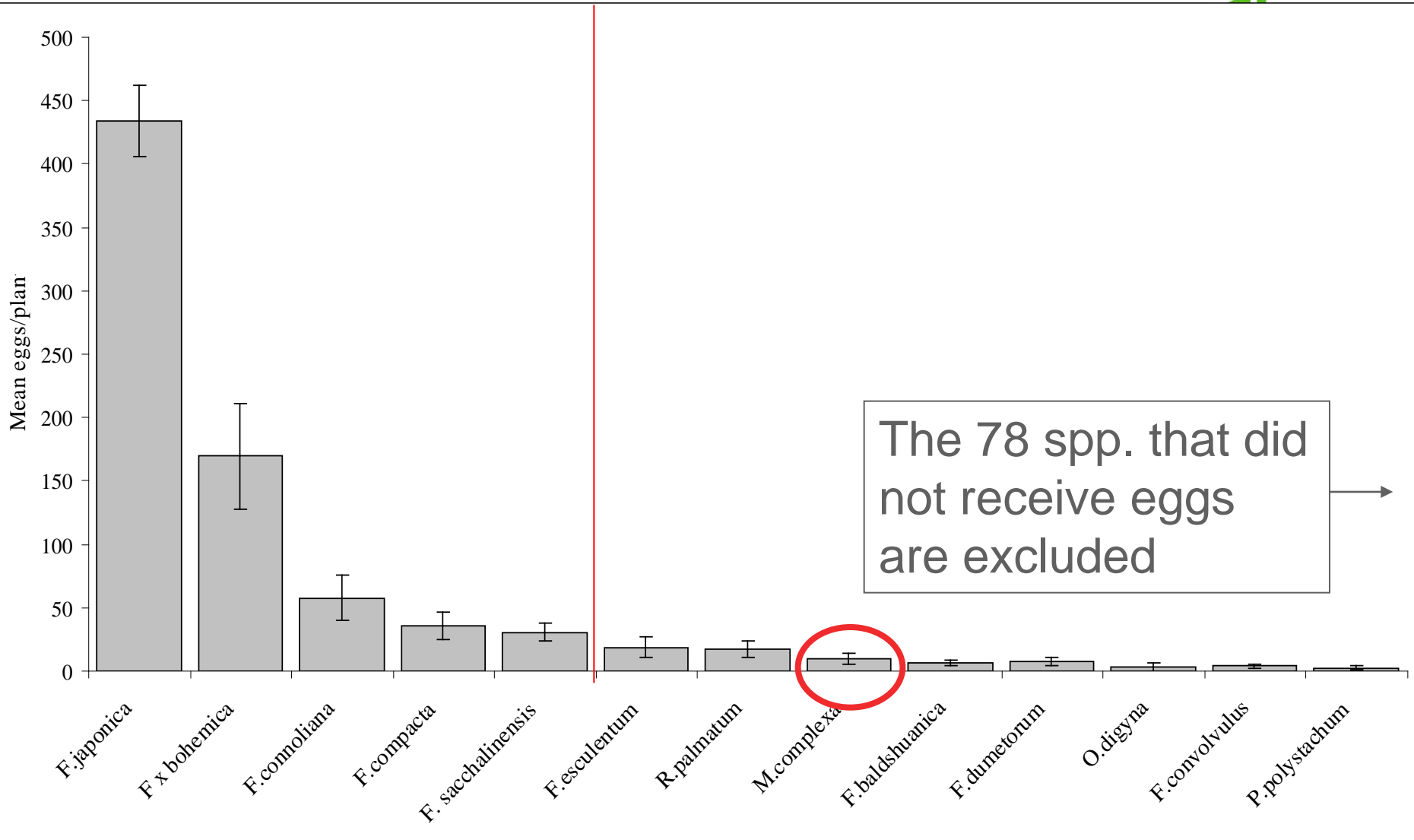
	Egg	1 <sup>st</sup> instar	2 <sup>nd</sup> Instar	3 <sup>rd</sup> instar	4 <sup>th</sup> instar	5 <sup>th</sup> instar	Complete life cycle
Mean ± 1SE	9.2 ± 0.1	4.8 ± 0.2	3.3 ± 0.2	3.9 ± 0.3	4.5 ± 0.1	7.1 ± 0.3	32.9 ± 0.8
Range	9 - 10	4 - 6	2 - 5	3 - 8	4 - 6	5 - 11	28 - 42

- Each female produces a mean of 637 eggs ± 121.96 (±1SE, n = 11).
- The mean period of production is 37.5 days ± 5.85 days (±1SE, n = 11).
- Adults live up to 67 days

# Test Plant List

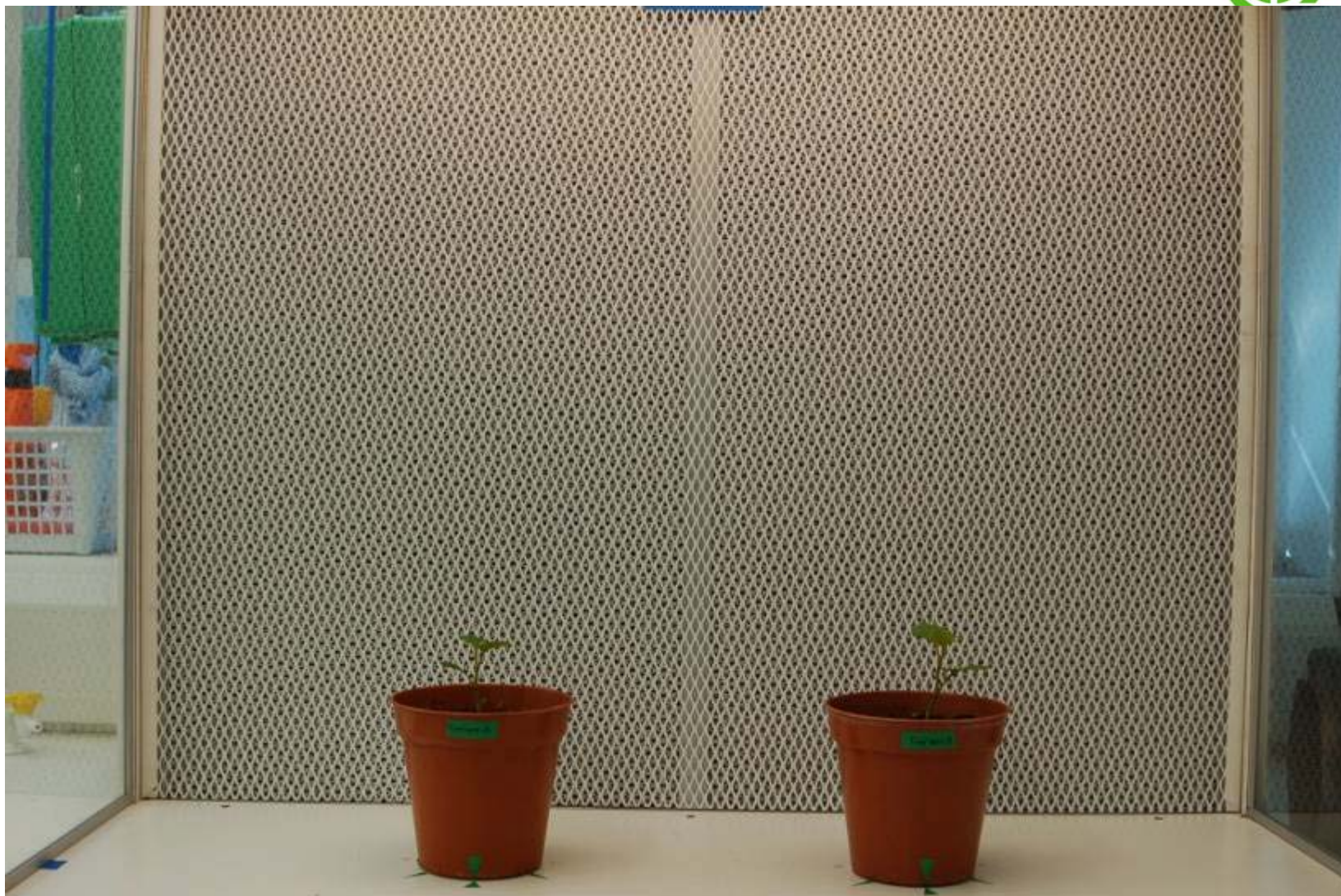
- 89 species and varieties
- representatives from 19 families.
- 37 plants natives including all native Polygonaceae
- 23 species introduced to the UK,
- 3 species native to Europe,
- 13 ornamental
- 10 economically important UK species



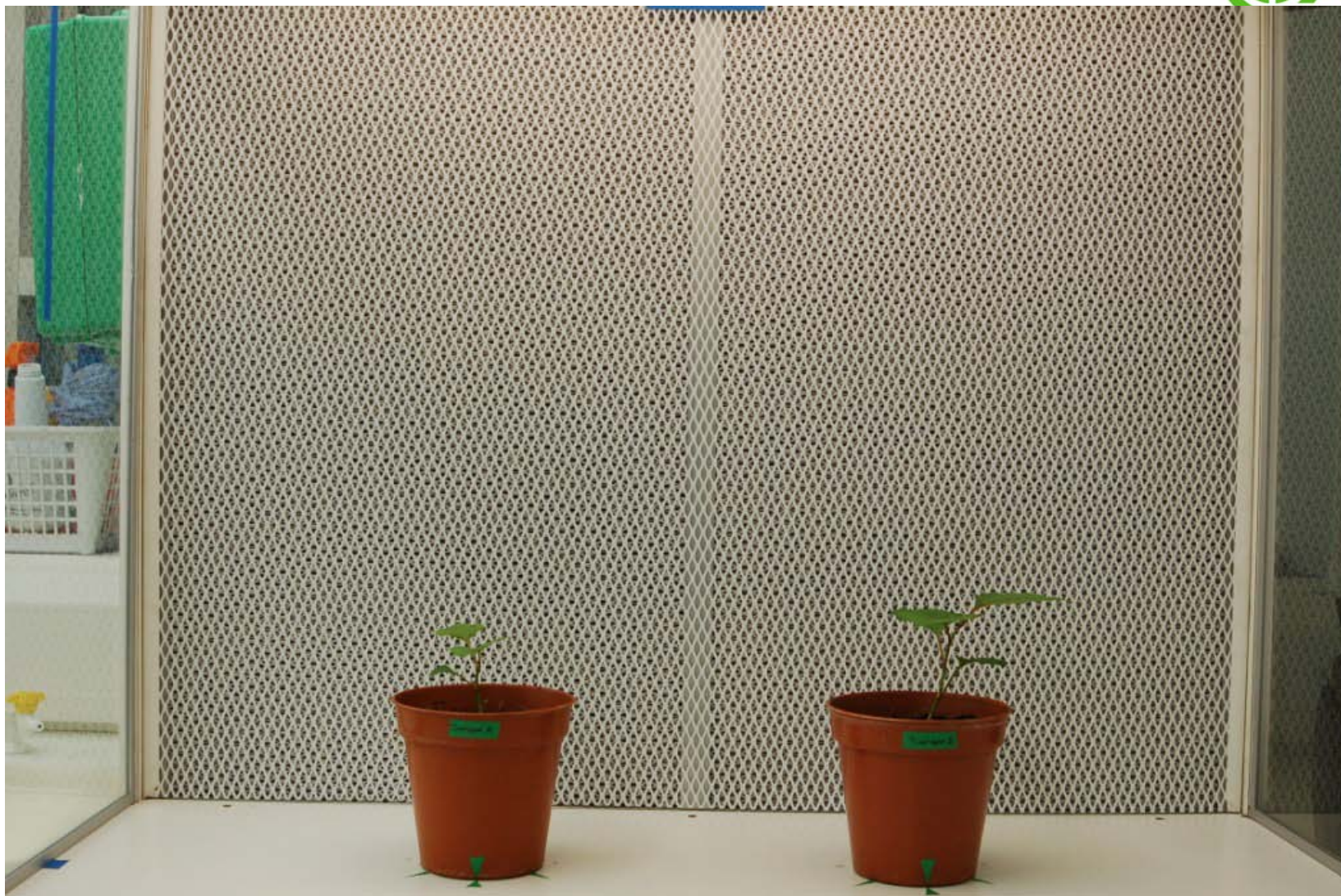


Bar chart showing mean egg count on those plants that did receive eggs in multiple choice oviposition tests. (+/- 1SE).

















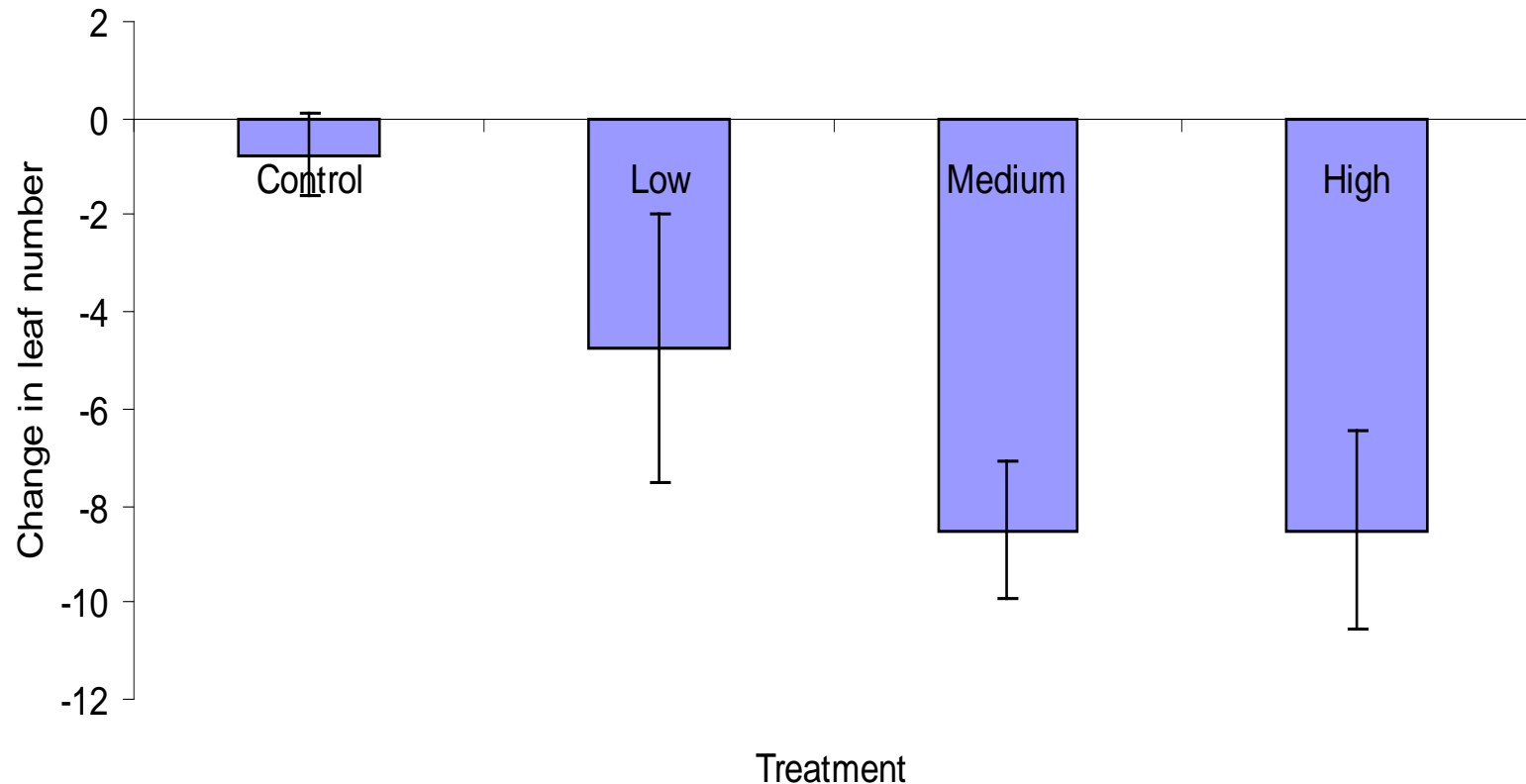






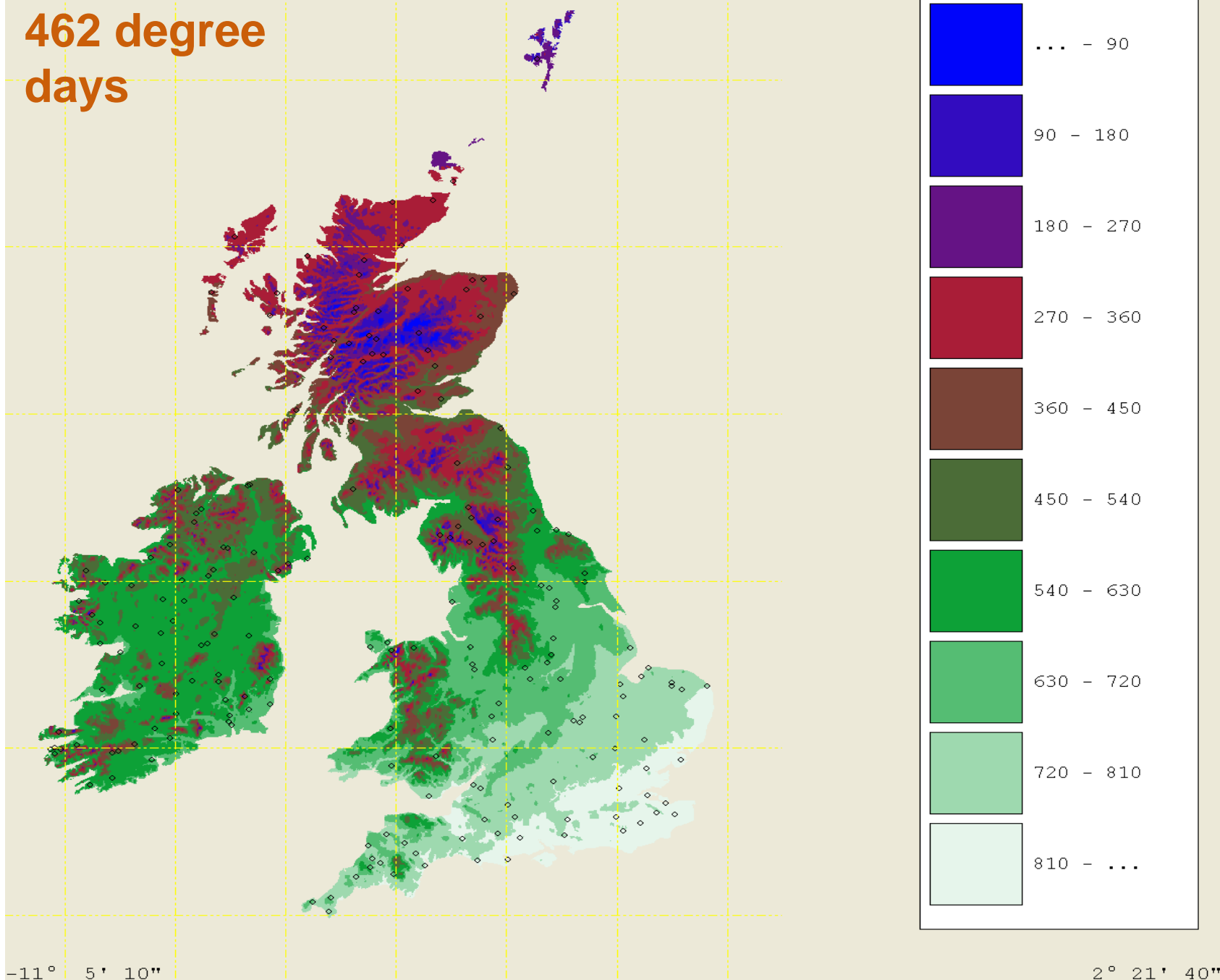


# Interaction with herbicide = Significant increase in leaf loss



Change in leaf number two weeks after spraying with sub-lethal dose of systemic herbicide following exposure to four levels of psyllid feeding

# 462 degree days



i.org

-11° 5' 10"

2° 21' 40"

## Licensing: The two processes (England)

- Licence to release into the wild under the Wildlife and Countryside Act 1981
- Licence to free it from a Plant Health Quarantine license as “an organism likely to be injurious to plants in the UK” - EU Standing Committee on Plant Health have been kept informed

See also: Hunt et al (2010) An international comparison of invertebrate biological control agent regulation: what can Europe learn? REBECA.

Pest Risk Analysis	W&C Act application for release
Based on Eppo template	Brand new version for Wales & England
Internal Govt iterative review	Internal Govt iterative review



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	ACRE Committee review

# 2° & 3° and community level effects?

Choice tests with commercially available generalists showed no feeding preference

Native coccinellids fed exclusively on psyllids fared worse than when fed on aphids

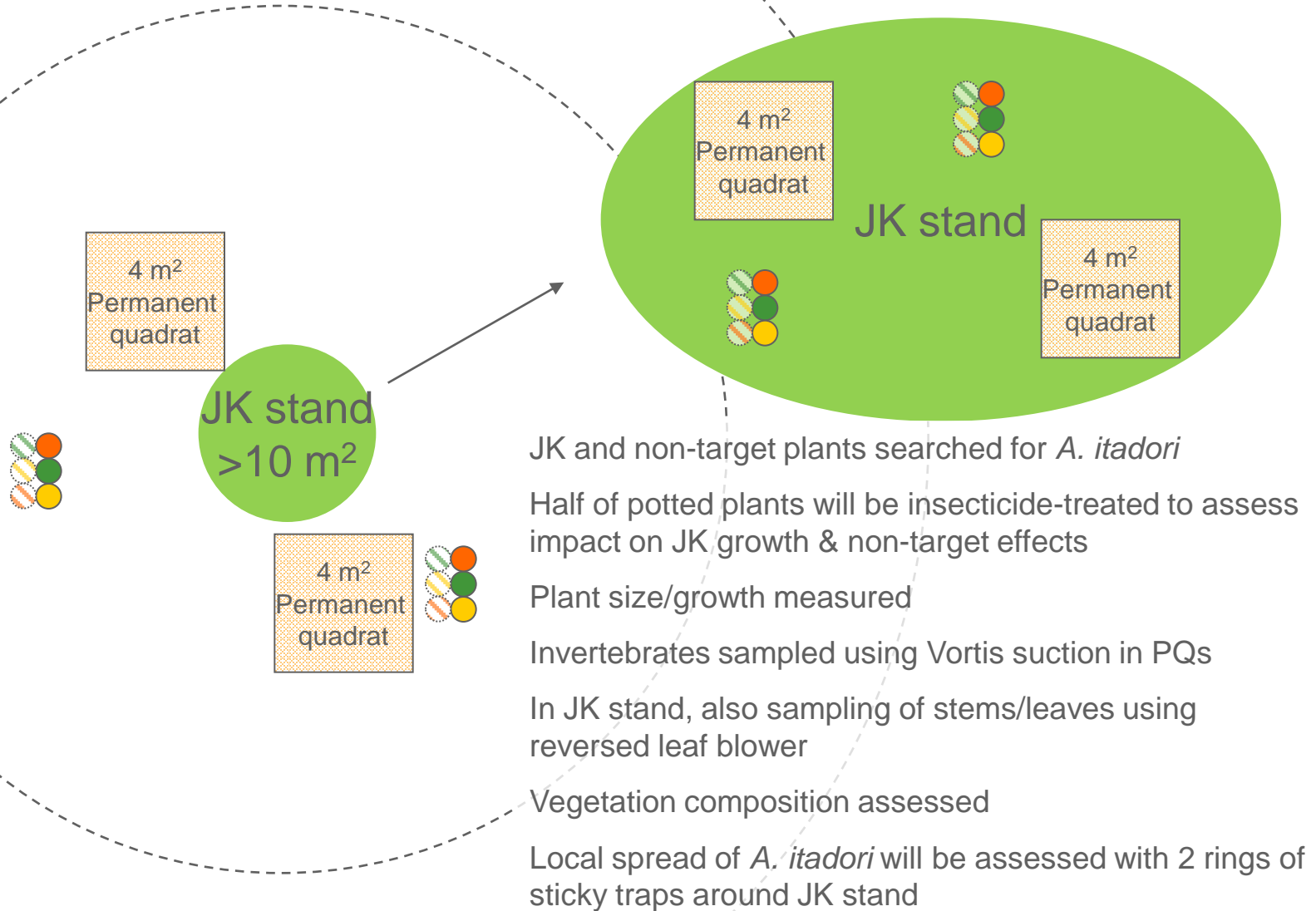


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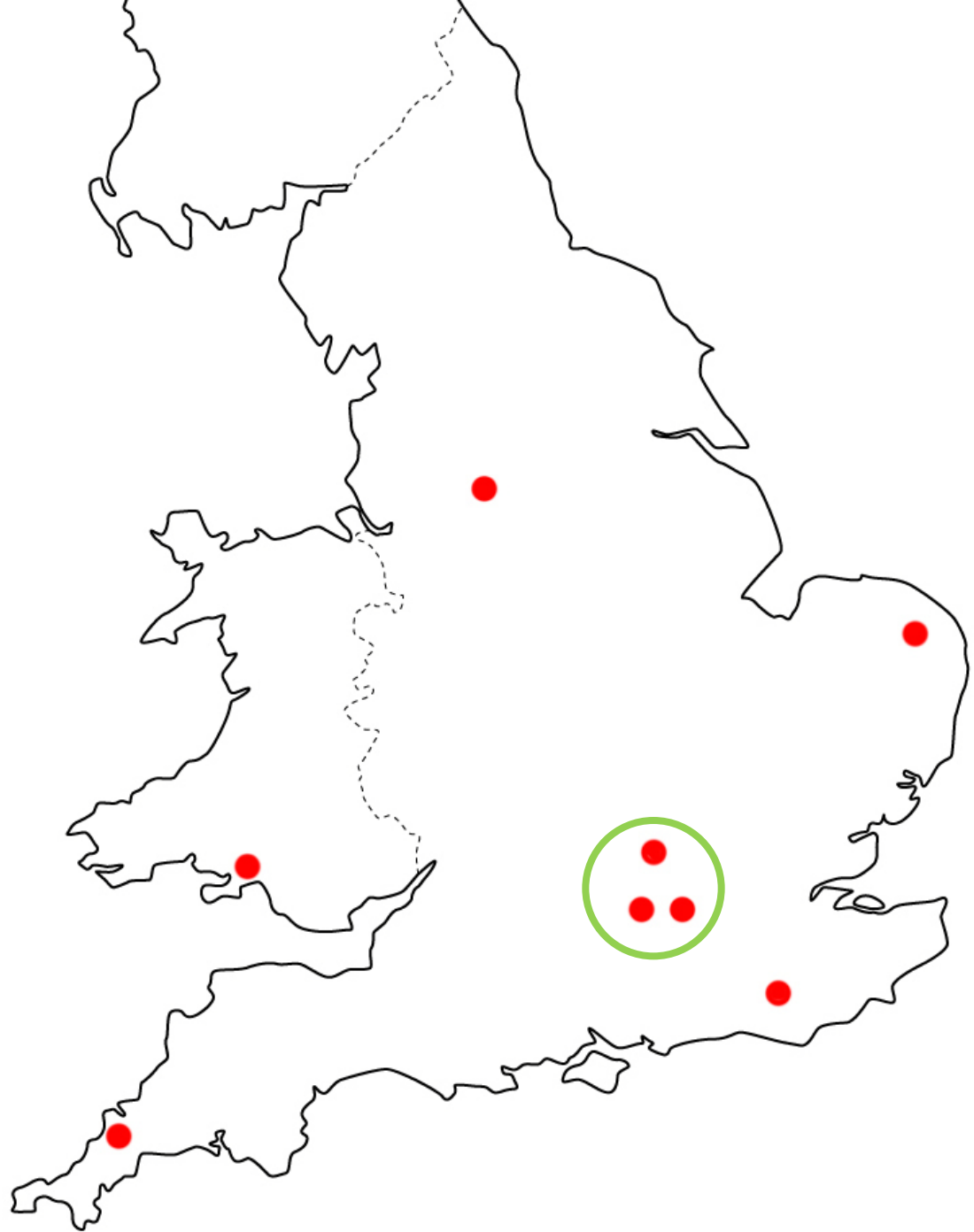
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External Peer review	External Peer review
Public consultation (3 months)	Public consultation (3 months)
Chief Scientist advice	Chief Scientist advice
Ministerial decision for Sec. of State	Ministerial decision for Sec. of State
Release from PH quarantine licence	W&C license to release

# Schematic plan for Phase I sites



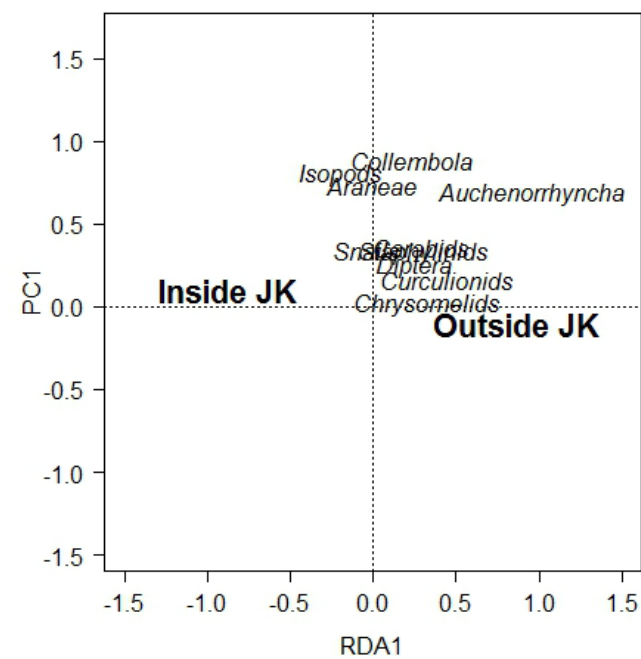
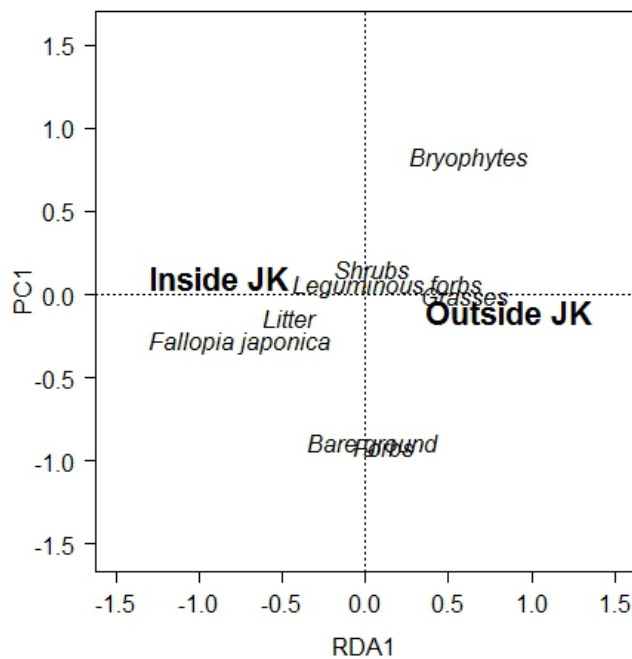
# Sites

Contingency plan for  
all sites



# Pre-release monitoring

- Differences between knotweed and surrounding habitat
- Differences in vegetation composition and invertebrate community (also fewer inverts in knotweed)





# Preparations for release

- Potted plants for the monitoring programme ongoing (*Fallopia dumetorum* and *F. convolvulus* grown from seed, knotweed plants collected from Phase I sites)
- Mass-rearing of psyllids (1,000s of adults, acclimatisation to outside temperature)



# Release

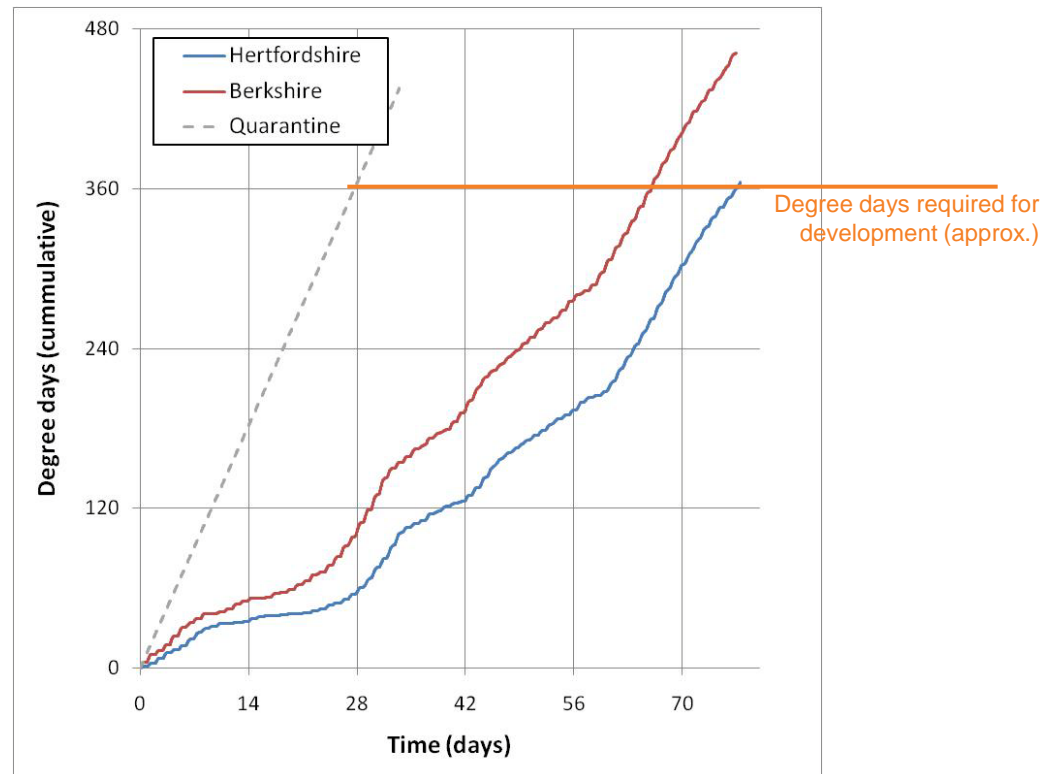
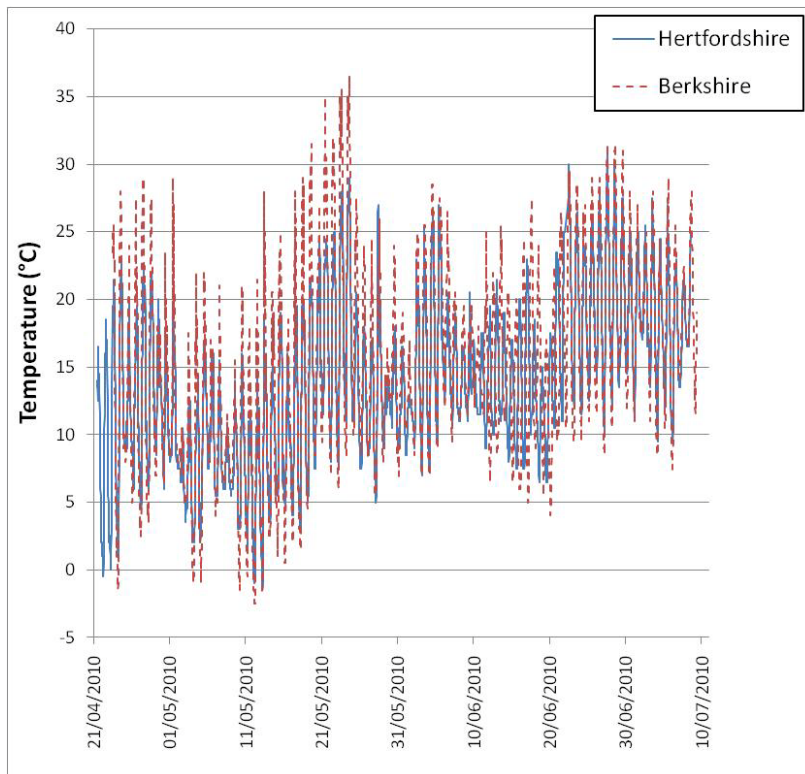
1,000 adults released at each site, 500 in sleeves



# Phase I progress

Coldest May for years

Climate data suggest adults may hatch soon



# Additional field cage studies



# What can we expect?



If successful:

- Establishment of the agent
  - Spread to JK
  - Reduced plant vigour
  - Reduced control costs
  - Recovery of native species
- 
- Control not eradication!

Djeddour, D.H., Shaw, R.H. (2010) The biological control of *Fallopia japonica* in Great Britain: review and current status. *Outlooks on Pest Management* 21 (1) pp15-18.

Shaw, R.H., Bryner, S. & Tanner, R. (2009). The life history and host range of the Japanese knotweed psyllid, *Aphalara itadori* Shinji: potentially the first classical biological weed control agent for Europe. *Biological Control* 49: 105-113

## Drivers for biocontrol



- The EU Strategy & CBD
- Sustainable Use Directive (chemicals are the last port of call)
- Water Framework Directive (all water bodies to reach “good ecological status” by 2015)

# Drivers: Water Framework Directive



Photo – T. Renals







# Thank you and thanks to all involved



- Dr Harry Evans (CABI),
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- Dr Daisuke Kurose (Kyushu University)
- Dr Narutu Furuya (Kyushu University)
- Dr Naoki Takahashi (Kyushu University)
- Yuko Inoue (Kyushu University)

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- Dr Bernd Blossey (Cornell University)
- Dr Rob Bouchier (AAFC Canada)
- Dr Brian Van Hezelwink (AAFC Canada)
- Victoria Nuzzo (Independent Consultant)
- Mic Julien (CSIRO)
- Dr Andy Sheppard (CSIRO)
- Dr Simon Fowler (Landcare Research NZ)
- Drs Ted Centre & Gary Buckingham (Florida Uni)
- Profs Mick Crawley & Tim Coulson (Imperial College)
- Dr Willie Cabrera Walsh (SABCL)
- Dr Jonathan Newman (CEH)
- Dr Usha Dev (NBPGR)
- Dr Ravi Kheterpal (NBPGR)
- Dr Robin Adair (DPI Queensland)
- Drs John Ireson & Richard Holloway (Utas)
- Lindsay Smith (Landcare Research)

- ACRE
- FERA – many especially Dr Claire Sansford
- Pesticide Safety Directorate
- The Non Native Species Secretariat

**The Project Board and sponsors for funding and guidance**

**Bernd & Roy for the invitation and support**

# Invasive Species Compendium (Alpha)



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Datasheets > Fallopia japonica (Japanese knotweed)

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Cover Images Identity Distribution Biology & Ecology Impacts Management References Report

Last modified: 29 June 2010

**Datasheet Type(s):** Pest, Invasive Species

**Preferred Scientific Name**

*Fallopia japonica*

**Preferred Common Name**

Japanese knotweed

**Taxonomic Tree**

Domain: Eukaryota

Kingdom: Plantae

Phylum: Spermatophyta

Subphylum: Angiospermae

Class: Dicotyledonae

[More...](#)

**Summary of Invasiveness**

*F. japonica* is an extremely invasive weed despite its lack of sexual reproduction in most of its introduced range. It is included on various lists of invasive weeds and is one of the 100 worst invasive species as identified by the IUCN. It is...

[More...](#)

Picture



click on the [picture](#) for further information

Distribution map



click on the [map](#) for further information