Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

The Invasive Alien Species Challenge

P.G. Mason

Ottawa Research and Development Centre, Ottawa, Ontario

Canada

IAS threats to Canadian agriculture

- Invasive alien species (IAS) are estimated to cost Canadian agriculture $6.7 billion ($5.3–$13.9 billion) per annum (*Coulatti et al. 2006 Biological Invasions 8: 45–59*)
- The eastern Palaearctic region, mainly China and Japan, is the origin of 15% of invasive plants to Canada
- Two major agricultural pests arrived in Canada:
  Spotted Wing Drosophila in 2009
  Brown Marmorated Stink Bug in 2010
- High potential for more big pests to arrive in Canada

Drosophila suzukii

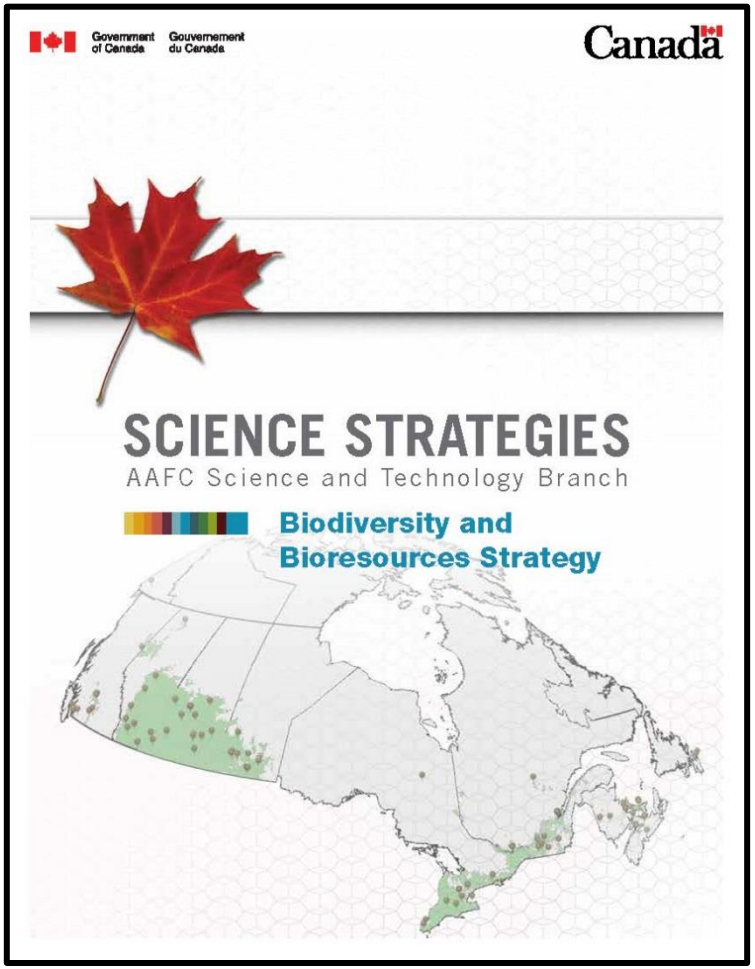
Halomorpha halys

Canada

www.cabi.org

Key Challenges and Opportunities for Biodiversity and Bioresources

Climate change, trade, and pest movements – Climate change and evolving trading relationships can influence pest populations and result in new pests or diseases establishing in Canada. Crops and livestock must be able to cope with increased incidence and severity of extreme climate and weather conditions.



Strategic Objectives[a]

Objective 2: Enhance Environmental Performance – Characterizing the ecological and evolutionary processes of plant parasitism and symbiosis, invasive species, and beneficial organisms that enhance the environmental performance of production systems.

Objective 4: Address Threats to the Value Chain –

Developing and enhancing knowledge of existing and emerging invasive species, pests and their hosts for risk identification, in anticipation of threats to agriculture and to support the development of diagnostic tests.

Providing authoritative scientific support to other government departments and agencies to assist them in meeting domestic legislation and regulations and to develop and implement strategies to prevent or mitigate the impact of pests and invasive species on agricultural production.

[a]AAFC Science & Technology Branch Biodiversity and Bioresources Strategy 2014

AAFC-CABI response

- Team approach
- Identify challenges
  - taxonomic
  - compatibility
  - methodology
- Implement program
  - discovery surveys
  - biological studies
  - host range testing

Cabbage seedpod weevil, *Ceutorhynchus obstrictus*

Trichomalus perfectus

Photos by T. Haye CABI

Canada

www.cabi.org

Team approach

Tim Haye
CABI Switzerland

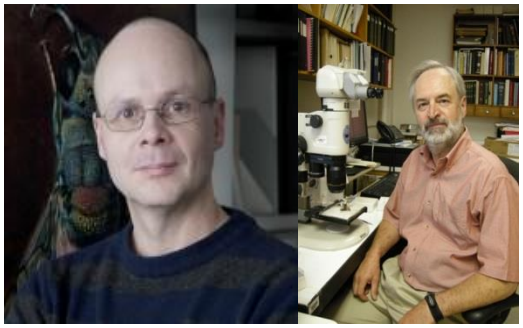
Ulli Kuhlmann
CABI Switzerland

Canadian students at CABI

Owen Olfert
AAFC Saskatoon

Dave Gillespie
AAFC Agassiz

Peter Mason
AAFC Ottawa



Hannes Baur
Naturhistoriche Museum Bern

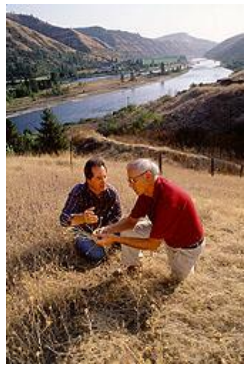
Gary Gibson
AAFC Ottawa

Patrice Bouchard
AAFC Ottawa

Lloyd Dosdall
University of Alberta

Hugh Philip
British Columbia Ministry of Agriculture

Scott Meers
Alberta Agriculture



Joe McCaffrey
University of Idaho

Canada

www.cabi.org

Challenges

On the misidentification of chalcid (Hymenoptera: Chalcidoidea) parasitoids of the cabbage seedpod weevil (Coleoptera: Curculionidae) in North America

Gary A.P. Gibson[1]

Agriculture and Agri-Food Canada, Biodiversity and Integrated Pest Management, K.W. Neatby Building, 960 Carling Avenue, Ottawa, Ontario, Canada K1A 0C6

Hannes Baur

Department of Inv

The species of Chalcidoidea (Hymenoptera) introduced to North America for biological control of the cabbage seedpod weevil, and the first recovery of *Stenomalina gracilis* (Chalcidoidea: Pteromalidae)

Gary A.P. Gibson[1]

Agriculture and Agri-Food Canada, Biodiversity and Integrated Pest Management, K.W. Neatby Building, 960 Carling Avenue, Ottawa, Ontario, Canada K1A 0C6

David R. Gillespie

Agriculture and Agri-Food Canada, Environmental Health, Integrated Pest Management Research Centre, P.O. Box 1000, Agassiz, British Columbia, Canada V0M 1A0

Lloyd Dosdall

Department of Agricultural, Food and Nutritional Science, 4–10 Agriculture/Forestry Centre, University of Alberta, Edmonton, Alberta, Canada T6G 2P5

J. Appl. Entomol. **130(3)**, 129–141 (2006) doi: 10.1111/j.1439-0418.2006.01040.x

Avoiding conflicts between insect and weed biological control: selection of non-target species to assess host specificity of cabbage seedpod weevil parasitoids

U. Kuhlmann[1], P. G. Mason[2], H. L. Hinz[1], B. Blossey[3], R. A. De Clerck-Floate[4], L. M. Dosdall[5], J. P. McCaffrey[6], M. Schwarzlaender[6], O. Olfert[7], J. Brodeur[8], A. Gassmann[1], A. S. McClay[9] and R. N. Wiedenmann[10]
[1]CABI Bioscience Switzerland Centre, Delémont, Switzerland; [2]Agriculture and Agri-Food Canada, ECORC, Ottawa, ON, Canada; [3]Department of Natural Resources, Cornell University, Ithaca, NY, USA; [4]Agriculture and Agri-Food Canada, LRC, Lethbridge, AB, Canada; [5]Department of Agricultural, Food & Nutritional Science, University of Alberta, Edmonton, AB, Canada; [6]Department of Plant, Soil, & Entomological Science, College of Agriculture, University of Idaho, Moscow, ID, USA; [7]Agriculture and Agri-Food Canada, Saskatoon, SK, Canada; [8]Institut de Recherche en Biologie Végétale, Université de Montréal, Quebec, Canada; [9]McClay Ecoscience, Sherwood Park, AB, Canada; [10]Department of Entomology, University of Arkansas, Fayetteville, AR, USA

Ms. received: October 2, 2005; accepted: D

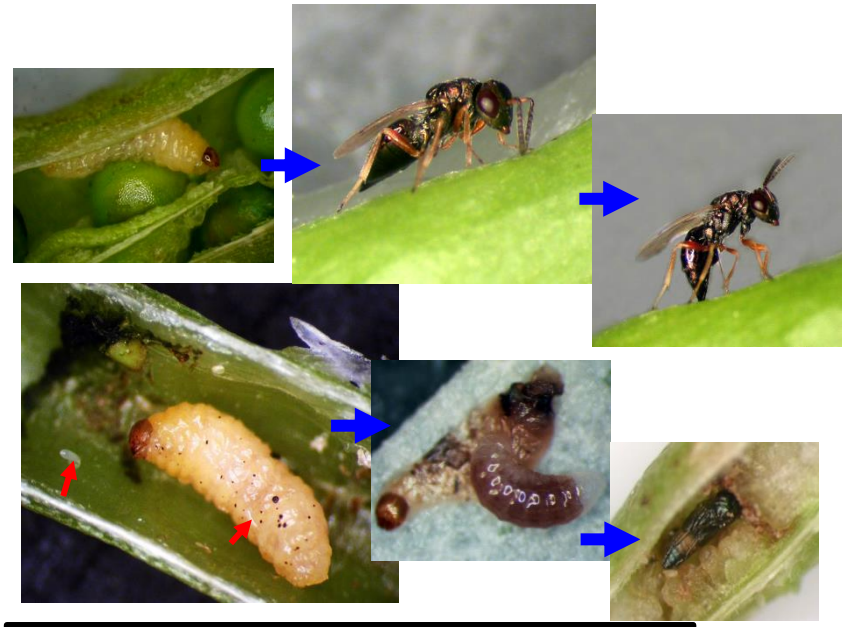
2 Selection of Non-target Species for Host Specificity Testing

Ulrich Kuhlmann,[1] Urs Schaffner[1] and Peter G. Mason[2]
[1]CABI Bioscience Switzerland Centre, Rue des Grillons 1, 2800 Delémont, Switzerland (email: u.kuhlmann@cabi.org; fax number: +41-32-4214871); [2]Agriculture and Agri-Food Canada, Research Centre, Central Experimental Farm, Ottawa, Ontario, K1A 0C6 Canada (email: masonp@agr.gc.ca; fax number: +1-613-7591701)

Canada

www.cabi.org

Implement a program



Field surveys for agents

Agent biology

Host range testing

Photos by T. Haye CABI

Biocontrol Science and Technology, 2015
Vol. 25, No. 1, 21–47, http://dx.doi.org/10.1080/09583157.2014.945900
Taylor & Francis
Taylor & Francis Group

RESEARCH ARTICLE

Determining the host specificity of the biological control agent *Trichomalus perfectus* (Hymenoptera: Pteromalidae): the importance of ecological host range

T. Haye[a]*, P.G. Mason[b], D.R. Gillespie[c], J.H. Miall[b], G.A.P. Gibson[b], A. Diaconu[d], A.M. Brauner[b] and U. Kuhlmann[a]

[a]*CABI, Delémont, Switzerland;* [b]*Agriculture and Agri-Food Canada, Research Centre, Ottawa, ON, Canada;* [c]*Agriculture and Agri-Food Canada, Research Centre, Agassiz, BC, Canada;* [d]*Institute of Biological Research, Iasi, Romania*

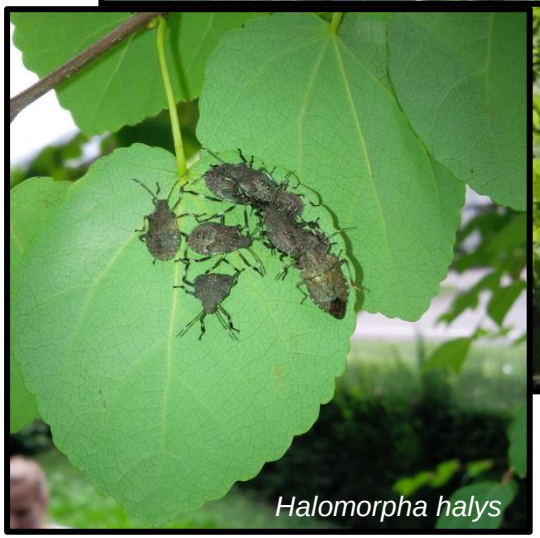
(*Received 10 April 2014; returned 17 June 2014; accepted 14 July 2014*)

Canada

www.cabi.org

Key targets

Dog strangling vine
Brown marmorated stink bug
Japanese knotweed
Spotted wing Drosophila
Houndstongue
Red clover case bearer
Yellow toadflax
Pollen beetle
Oxeye Daisy
Apple ermine moth
Hoary Cress
Cabbage seedpod weevil
Field bindweed
Leek moth

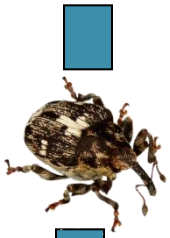


Canada

www.cabi.org

Successful Biological Control of houndstongue

- *Mogulones crucifer* released in 1997; *Longitarsus quadriguttatus* released in 1998
- *Mogulones crucifer* most successful, near 100% establishment
- Current work includes: assessing genetic variation and impacts of invasive plants; examining impact of climate change on current and potential invasive plants; developing novel screening, release and enhancement strategies for biocontrol agents



R. De Clerck-Floate, AAFC Lethbridge

Canada

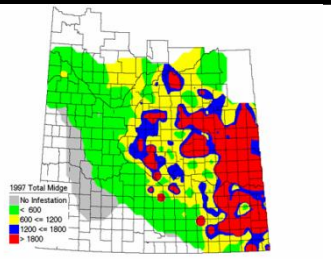
www.cabi.org

Successful Biological Control of orange wheat blossom midge

- *Macroglenes penetrans* discovered in 1984; *Platygaster tuberosula* and *Euxestonotus error* released in 1995
- Between 1992-2010 parasitism by *M. penetrans* averaged 35%; 2011 evidence of *P. tuberosula* establishment; parasitism is a major component of pest forecast
- Current work includes: monitoring to determine establishment of *E. error* and spread of *P. tuberosula*; developing conservation strategies to ensure parasitoids continue to play a major role in regulating wheat midge in Canada

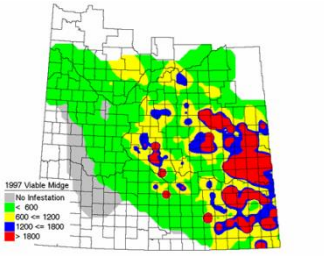
P. Mason, AAFC Ottawa

Sitodiplosis mosellana



Before parasitism determined

Macroglenes penetrans



Adjusted for parasitism

Photos courtesy of O. Olfert, AAFC

Canada

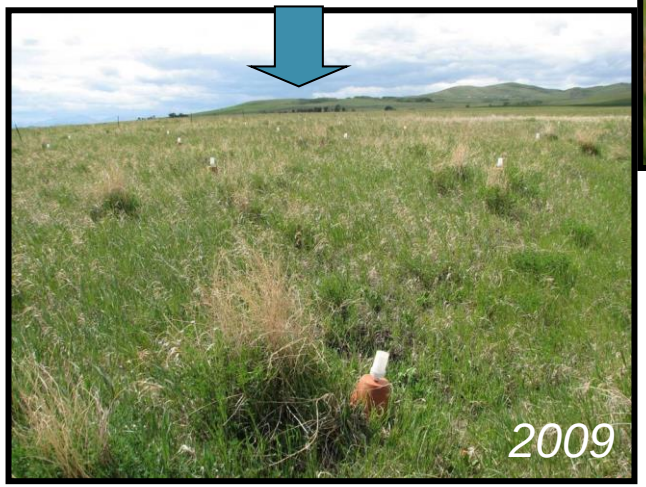
www.cabi.org

Successful biological control of leafy spurge

- *Hyles euphorbiae* released in 1965; *Apthona cyparissiae & A. flava* released in 1982; *Apthona nigriscutus* released in 1983; *Apthona czwalinae* released in 1985; *Apthona lacterosa* released in 1990

- *Apthona nigriscutus & A. lacertosa* most successful

- Current work includes relocation of established populations and assessing population dynamics



Euphorbia esula

R. Bourchier, AAFC Lethbridge

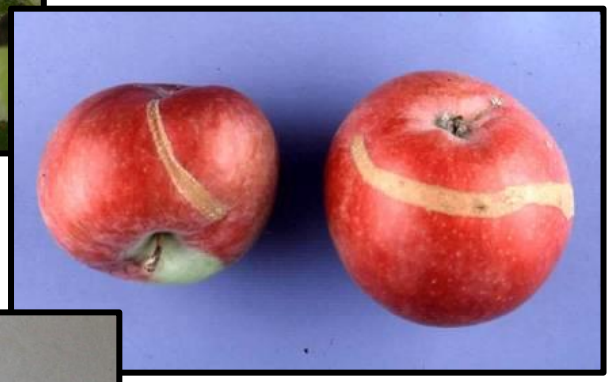
Canada

www.cabi.org

Successful Biological Control of European Apple Sawfly

- *Lathrolestes ensator* released from 1995 to 2002 in Québec (1050 individuals)
- By 2005 24-50% parasitism levels had been achieved
- Current work includes: introduction of *L. ensator* into Ontario apple orchards; monitoring dispersal of *L. ensator* to new areas infested by *H. testudina* in Canada

Hoplocampa testudinea



Lathrolestes ensator

P. Mason, AAFC Ottawa

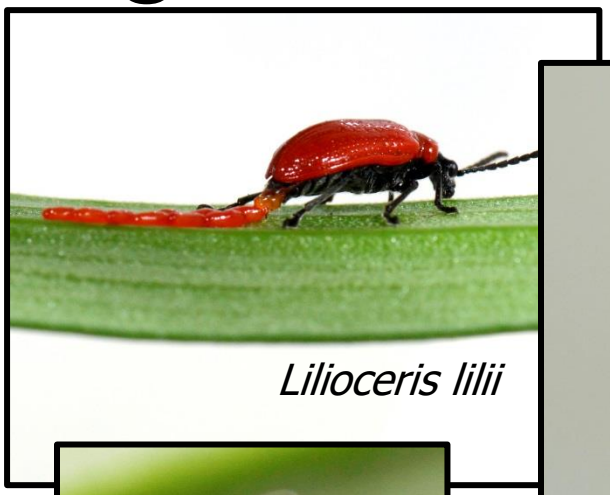
Photos by C. Vincent, AAFC

Canada

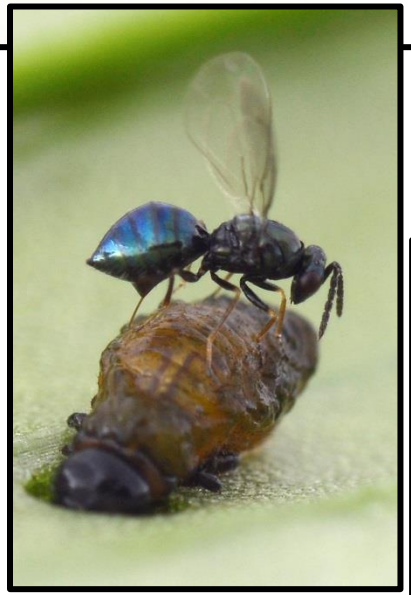
www.cabi.org

Successful Biological Control of lily leaf beetle

- *Tetrastichus setifer* released in 1999 (2010 in Canada); *Diaparsis jucunda* released in 2003, *Lemophagous errabundus* released in 2003
- *Tetrastichus setifer* most successful, widespread, up to 100% parasitism
- Current work includes: introduction of *T. setifer* into areas newly invaded by lily leaf beetle (e.g. western Canada); monitoring dispersal of *T. setifer* to lily leaf beetle on novel plant hosts; developing a bioclimatic model to predict dispersal of *T. setifer*; release of *L. errabundus* in Canada



Lilioceris lilii



Tetrastichus setifer

P. Mason, AAFC Ottawa

Photos by A.M. Brauner, AAFC

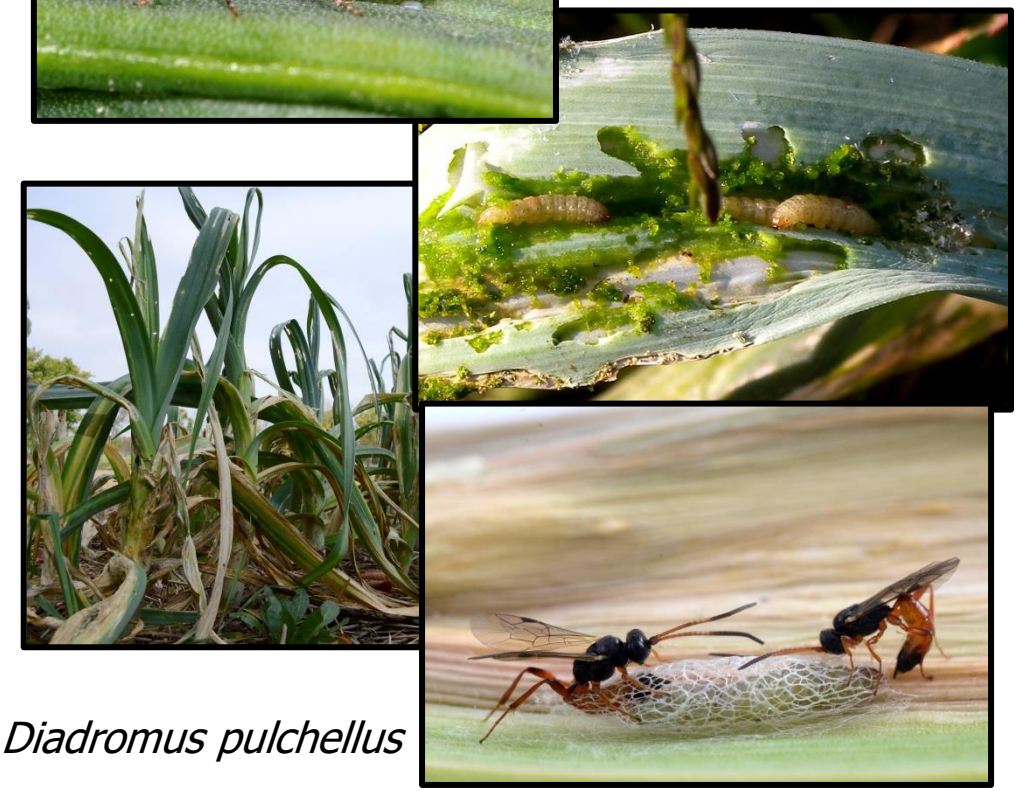
Canada

www.cabi.org

‘Successful’ Biological Control of leek moth

- *Diadromus pulchellus* released in 2010
- *Diadromus pulchellus* has successfully overwintered, population appears to have established
- Current work includes: introduction of *D. pulchellus* into areas newly invaded by leek moth; monitoring dispersal of *D. pulchellus*; testing host range hypotheses; developing post-release monitoring protocols; developing a bioclimatic model to predict dispersal of *D. pulchellus*; evaluation of additional candidate agents

Acrolepiopsis assectella



Diadromus pulchellus

Photos by A.M. Brauner, AAFC

P. Mason, AAFC Ottawa

Canada

www.cabi.org

Research priorities

- Determine biocontrol potential for IAS before they become a threat
  - ➢ CABI + member countries
- Identify new BCAs and assess risk
  - ➢ CABI + member countries
- Understand IAS host-natural enemy communities and effects of global change
  - ➢ CABI + member countries
- Develop risk assessment methodologies
  - ➢ CABI + member countries
- Build DNA library of BCAs
  - ➢ CABI + member countries

Canada

www.cabi.org

Thank you

Canada