EMBRAPA MEIO AMBIENTE
Jaguariuna, Sao Paulo, Brazil
September 30, 2010

Importation and Application of Natural Enemies
for Biological Control

PROSPECTING BIOLOGICAL CONTROL AGENTS ABROAD FOR REAL
-
IS IT STILL POSSIBLE?

D. COUTINOT

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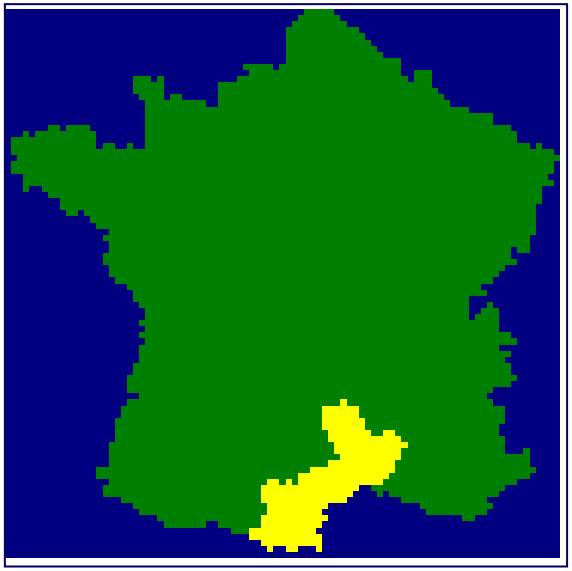
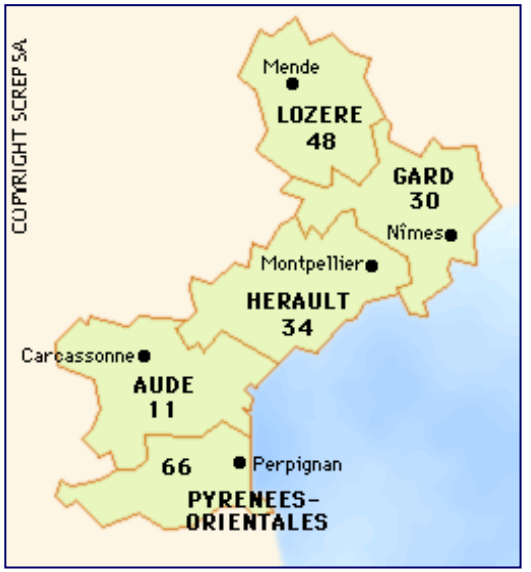
European Biological Control Laboratory

USDA-ARS Overseas Laboratory

Montpellier, France

(EU)





France – Languedoc-Roussillon Region – Hérault Department

EUROPEAN BIOLOGICAL CONTROL LABORATORY
USDA – ARS
MONTPELLIER, FRANCE, EU

European Biological Control Laboratory

- **The OBJECTIVE**

  of the research at EBCL is to develop BC technologies which can be used to suppress invading insect pests and weeds.

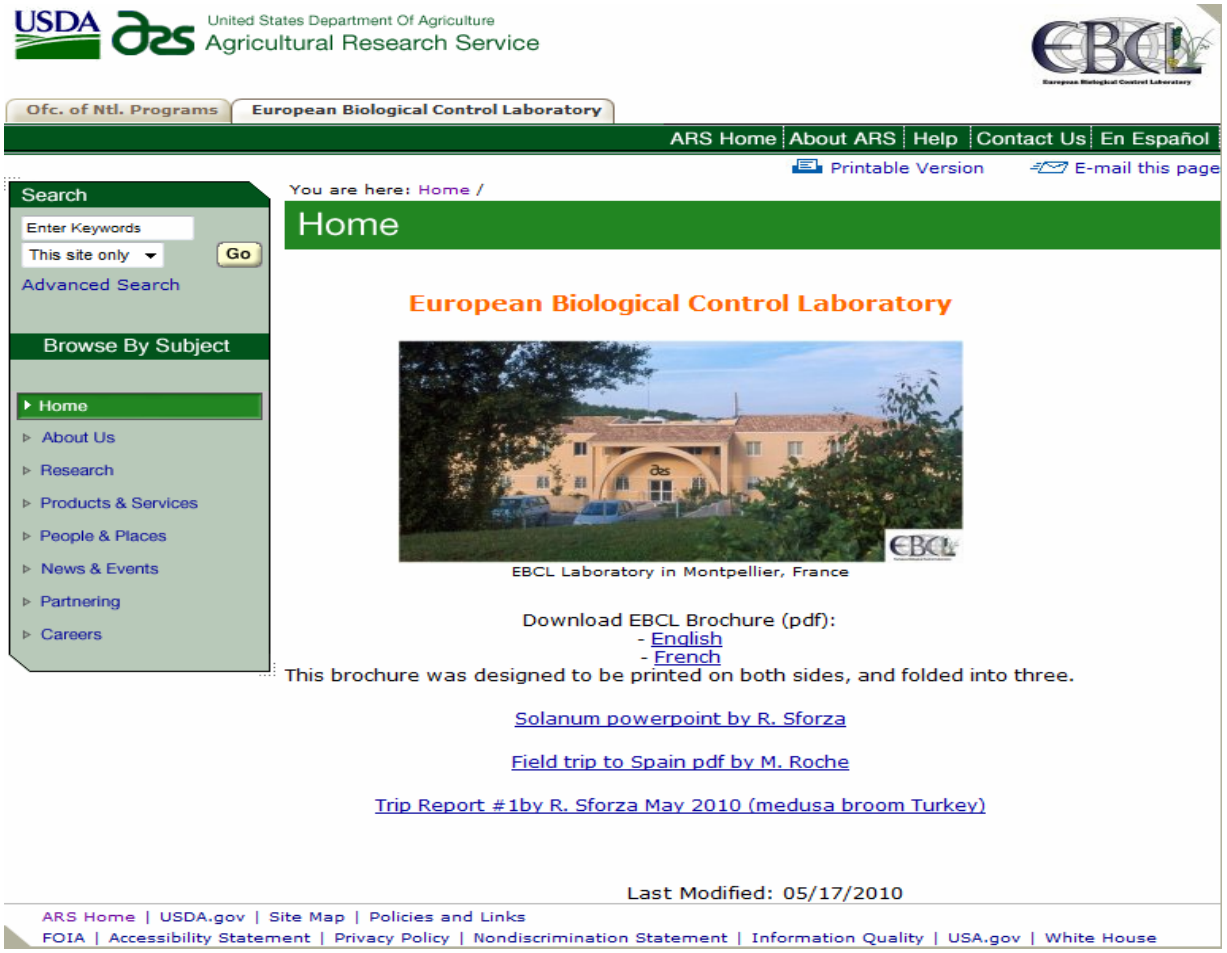
- **The MISSION**

  is to locate and characterize natural enemies :

  insects, mites and pathogens.

USDA ARS European Biological Control Laboratory

Solutions from Nature



http://www.ars.usda.gov/Main/site_main.htm?modecode=02-12-00-00

Daniel.Strickman@ars.usda.gov

Who we work for

- USDA—Secretary Tom Vilsack
- Research Education and Economics– Chief Scientist Catherine Wotecki (nominated)
- Agricultural Research Service—Ed Knipling
- Office of National Programs—Judy St. John
- Crop Production and Protection—Sally Schneider (acting)
- Overseas Biological Control Labs—Dan Strickman (acting)
- European Biological Control Laboratory—Dan Strickman (interim)

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What we do

- Find *natural enemies* of invasive weeds and pests
  - Insects that eat plants
  - Insects that parasitize insects
  - Fungi, bacteria, and nematodes
- Test effectiveness of natural enemies
- Test safety of natural enemies
- Perform legal shipment of specimens

How we do it

- People: 18 French, 2 American in Montpellier; 2 Greek in Thessaloniki
- Facilities: US-owned lab and land in Montpellier; rented space at American Farm School, Thessaloniki
- Funds: $3.5M base funds; $200K soft funds
- Integrated with other ARS labs doing biocontrol
- Cooperators: Italy, Turkey, Spain, France, Russia, Bulgaria, Cameroun, Namibia
- Stakeholders: California, Wyoming, Oregon, Washington, New York, Canada

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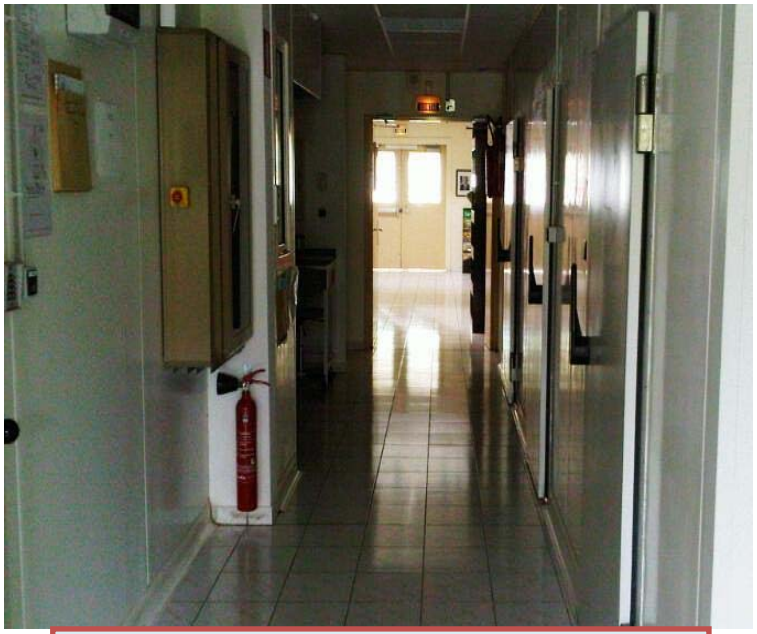
Molecular biology laboratory

Certified quarantine facility and plot space



BL3 lab and growth chambers

Lab is Embassy inspected and ICASS served

Current Areas of Work

Insects

- Asian longhorned beetle
- Citrus longhorned beetle
- Olive fruit fly
- Olive psylla
- European grape berry moth
- Lygus bug
- Sand flies (leishmaniasis)
- Mosquitoes

Weeds

- Swallow wort
- Silverleaf nightshade
- Yellow star thistle
- Common bindweed
- Giant reed
- Guinea grass
- Medusahead rye
- Knapweeds
- White top (pepper grass)
- Russian thistle (tumble weed)

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Future Directions

- Administrative improvement
  - Procedures for Americans to arrive and depart
  - Relief from VAT
  - Web page
  - Communication to Embassy, USDA, and stakeholders
- Increase external funding
  - Afghanistan
  - Olive psylla
  - Olive fruit fly
  - European grape berry moth
  - Medusahead rye
- Expand mission
  - Climate change
  - Sub-Saharan Africa food security
  - Medical/Veterinary Entomology
- Increase collaboration with French institutions
  - INRA
  - CIRAD
  - CBGP
  - Universities of Montpellier
  - IRD

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European Biological Control Laboratory

BIOCONTROL OF INSECT PESTS

Bactrocera oleae
(Diptera: Tephritidae)
Psyttalia lounsburyi
(Hym. : Braconidae)

© A. Blanchet

Anoplophora chinensis
(Col. : Cerambycidae)
Euderus caudatus
(Hym. : Eulophidae)

© F. Hérard

Planococcus ficus
(Hem.: Pseudococcidae)
Anagyrus pseudococci
(Hym. Encyrtidae)

© R. Sforza

Lygus pratensis
(Hem.: Miridae)
Peristenus relictus
(Hym. : Braconidae)

© D. Coutinot

European Biological Control Laboratory

EBCL Olive Fruit Fly Project
Bactrocera oleae

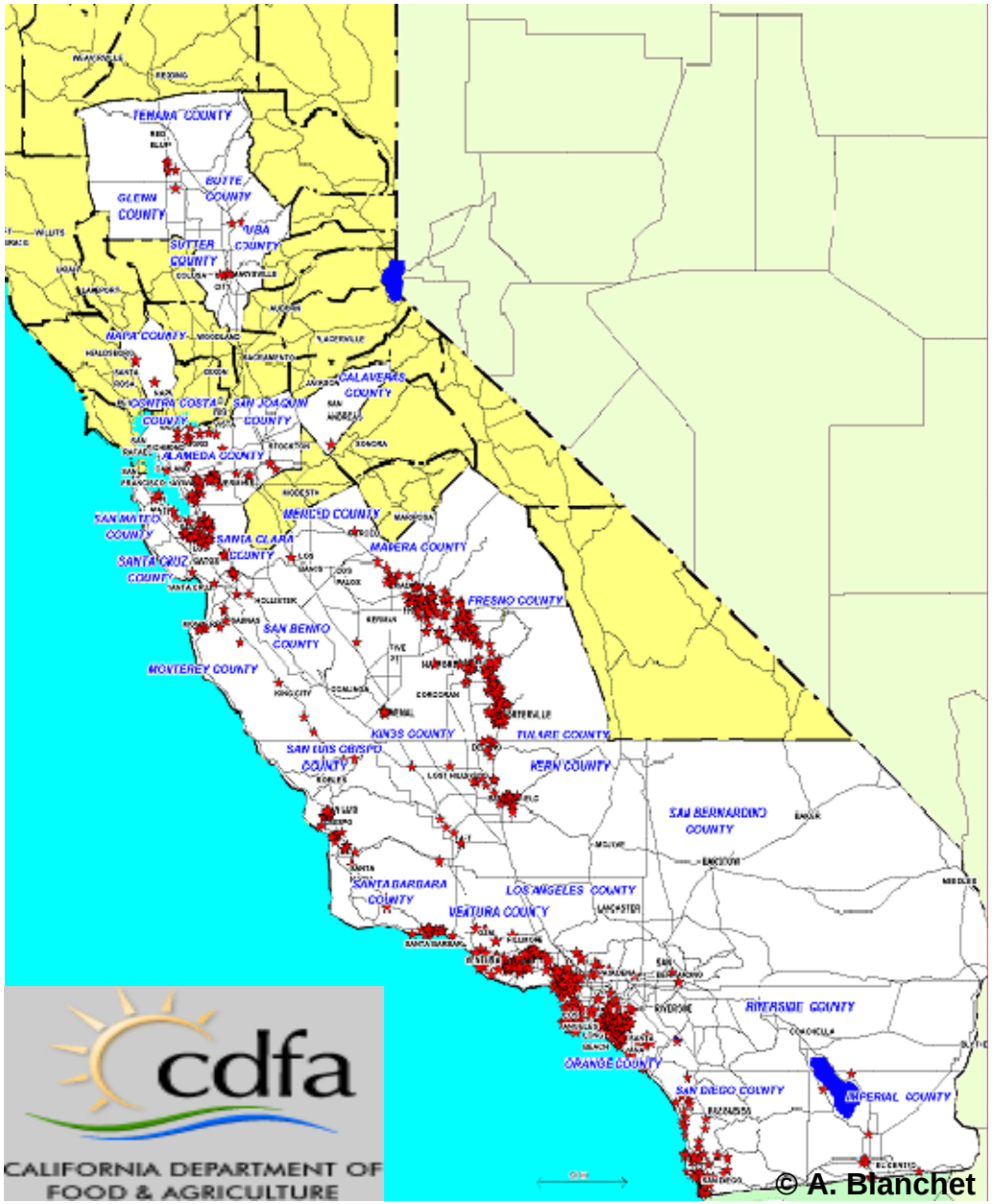
- ✓ OLF : *Olea europea subspecies*
  Mediterranean region
  Asia & Africa

- ✓ First detection in CA 1998
  spread all over CA in 3 years

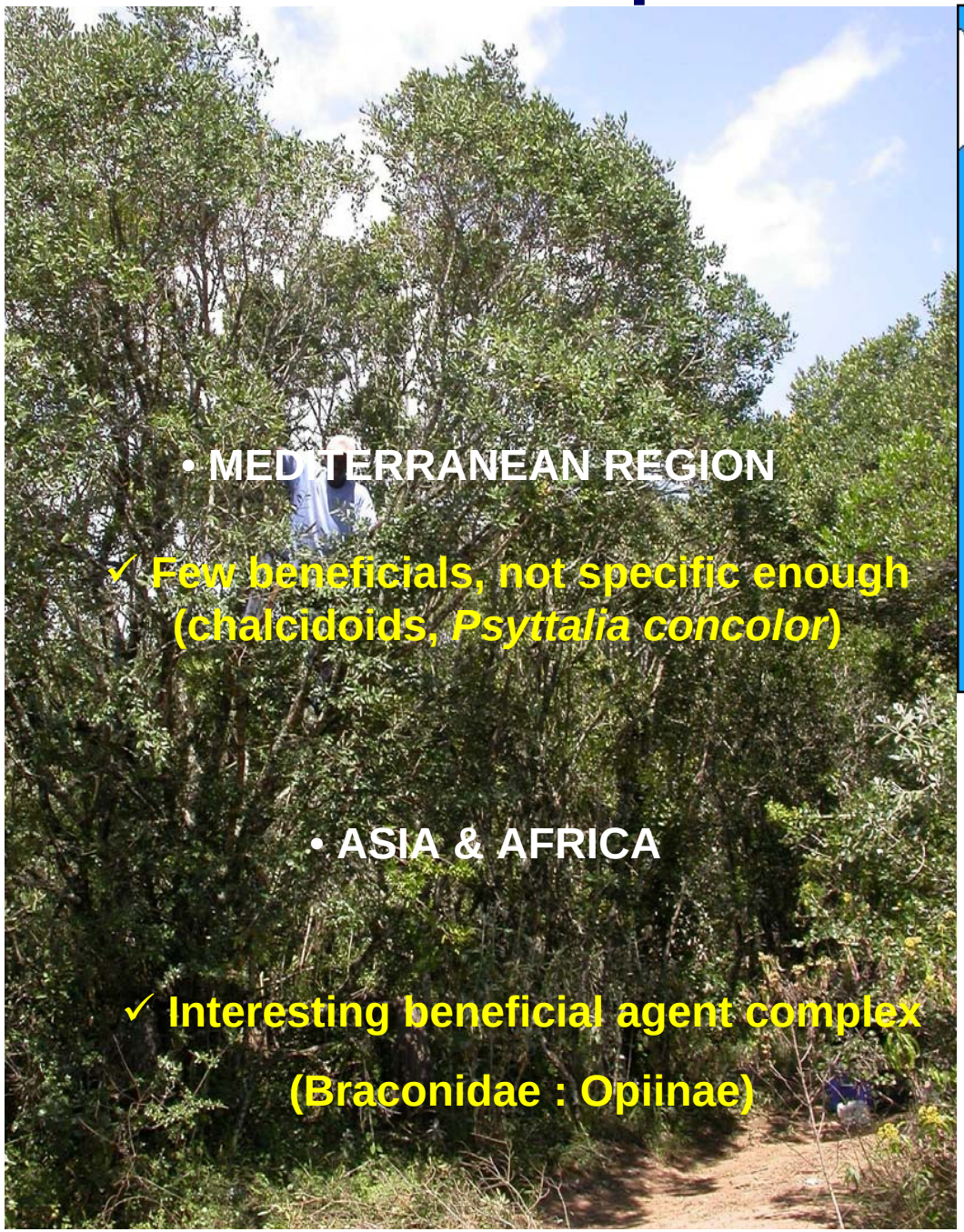
- ✓ Project initiated by CDFA in 2000
  - M. Pitcairn
  - C. Pickett

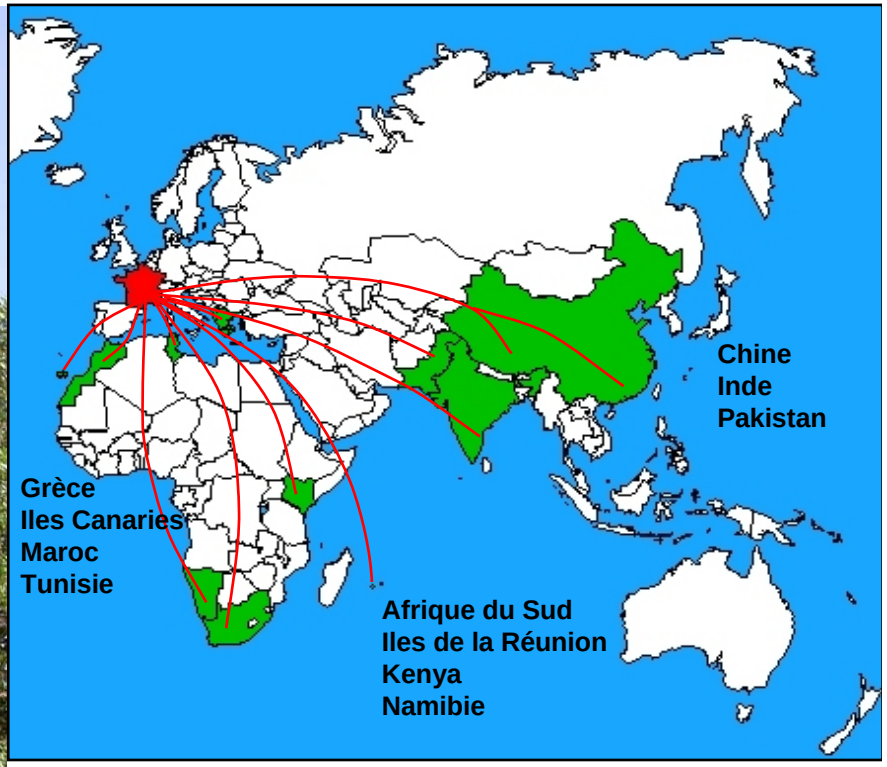
- ✓ EBCL Montpellier, France
  - K. Hoelmer
  - A. Kirk
  - W. Jones
  - A. Blanchet
  - D. Strickman

- ✓ Objectives: Foreign exploration, field collection, production and export to CA through EBCL quarantine facilities.



EBCL Explorations 2000 – 2010





Braconidae parasitoids

Bracon sp

Diachasmimorpha sp

Psyttalia concolor

Psyttalia ponerophaga

Psyttalia lounsburyi

Utetes africanus

© A. Blanchet

OLF Activities 2000 – 2009

A. Blanchet EBCL, Montpellier France

EBCL Quarantine:

1. **Field material from foreign countries:**

   - ✓ **Wild infested olives i.e. : 2007 NA, SA, KE, 15 900 olives**
   - ✓ **OLF pupae i.e. : 2002-2008 KE, > 50 000 pupae**

2. **Research to develop and improve rearing technics:**
   i.e. : *Psyttalia lounsburyi*
   A NOVEL REARING TECHNIQUE FOR THE OLIVE FRUIT FLY PARASITOID PSYTTALIA LOUNSBURYI (HYMENOPTERA: BRACONIDAE) ON CERATITIS CAPITATA (DIPTERA : TEPHRITIDAE) IN ARTIFICIAL DIET Blanchet, A., Hurtrel, B., Roche, M., Kirk, A., & Jones, W. A.

3. **Production & Exports of parasitoids to US cooperators:**
   i.e. : 2006-2008 : 28 800 *P. lounsburyi* SA, NA, KE
   25 000 *P. concolor* SA, NA, KE

Collaborations with:

INRA, France	**Genetic and field releases**
COHEN Institute, Israël	**Field releases, production**
Comision Moscamed, Guatemala	**Production**
Future : Albania	**Olive fly biocontrol program**

© A. Blanchet

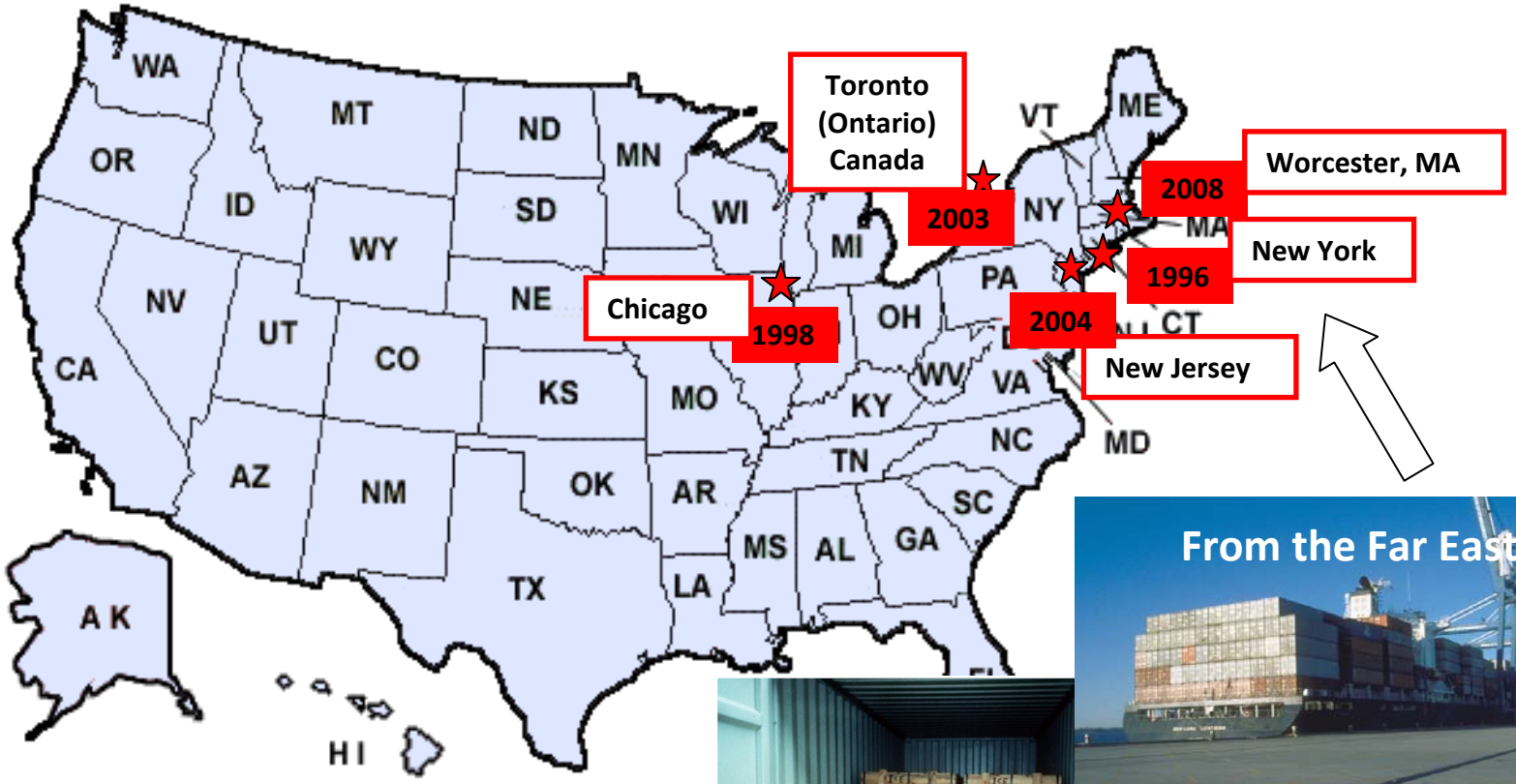
TWO INVASIVE SPECIES: ASIAN LONGHORNED BEETLES

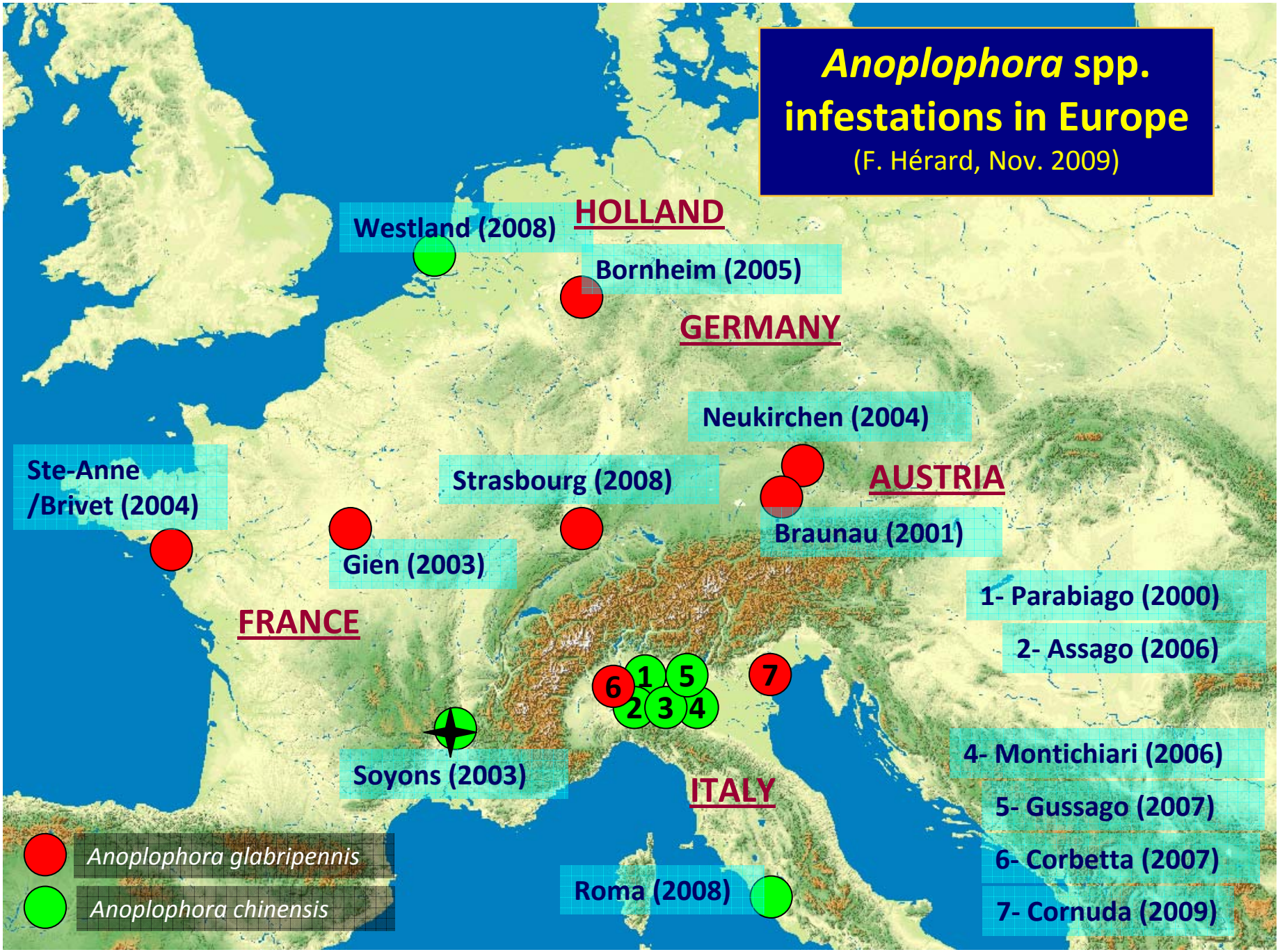
Anaplophora glabripennis **(Motschulsky)**
(ALB **=** Asian Longhorned Beetle)

Coleoptera: Cerambycidae, Lamiinae

Anaplophora chinensis **(Forster)**
(CLB = Citrus Longhorned Beetle)

Anoplophora glabripennis infestations in North America (F. Hérard, Nov. 2009)




Anoplophora spp. infestations in Europe
(F. Hérard, Nov. 2009)
HOLLAND
Westland (2008)
Bornheim (2005)
GERMANY
Neukirchen (2004)
AUSTRIA
Braunau (2001)
Strasbourg (2008)
Ste-Anne /Brivet (2004)
Gien (2003)
FRANCE
1- Parabiago (2000)
2- Assago (2006)
4- Montichiari (2006)
5- Gussago (2007)
6- Corbetta (2007)
7- Cornuda (2009)
Soyons (2003)
ITALY
Roma (2008)
Anoplophora glabripennis
Anoplophora chinensis

Anoplophora chinensis: early stage parasitoids in Italy

Egg host

Larval host

Pest imported from the Far East; established in Italy near Milan on ornamentals and deciduous trees

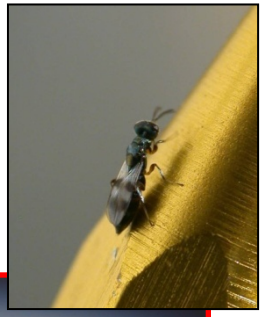
Aprostocetus anoplophorae
(Hym.: Eulophidae)

Spathius erythrocephalus
(Hym.: Braconidae)

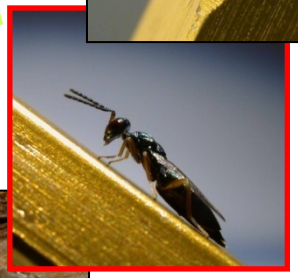
Eurytoma melanoneura
(Hym.: Eurytomidae)

Eurytoma morio
(Hym.: Eurytomidae)

Eupelmus aloysii
(Hym.: Eupelmidae)



Cleonymus brevis
(Hym.: Pteromalidae)



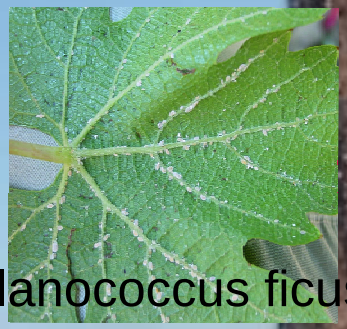
Trigonoderus princeps
(Hym.: Pteromalidae)

Calosota agrili
(Hym.:Eupelmidae)

***Sclerodermus* sp.**
(Hym.: Bethylidae)

(also attacked *A. glabripennis)*

Photos: F. Hérard



Planococcus ficus

Anagyrus pseudococci

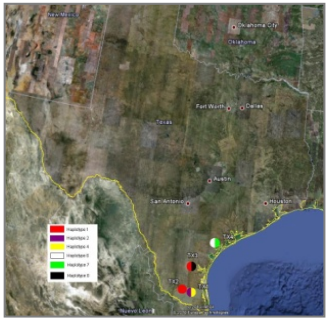
Lobesia botrana

Biocontrol of grape pests with parasitoid insects

© R.Sforza -USDA

European Biological Control Laboratory

BIOCONTROL OF PLANT PESTS

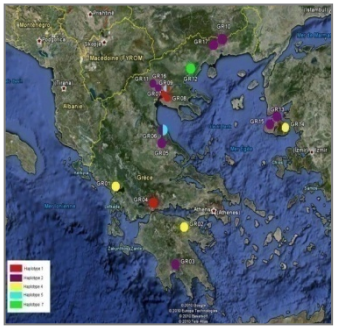


Vincetoxicum spp.
(Apocynaceae)
Chrysochus asclepiades
(Col.: Chrysomelidae)

© R. Sforza

Panicum maximum Jacq.
(Poaceae)
Id.
Lepidoptera stemborer

© G. Mercadier



Solanum elaeagnifolium
Cavanilles (Solanaceae)
Tracing the origin
Texas, USA to Greece, EU

© M-C Bon

Arundo donax
(Gramineae)
Rhizaspidiotus donacis
(Hom.: Diaspididae)

© A. Kirk

Sforza
René

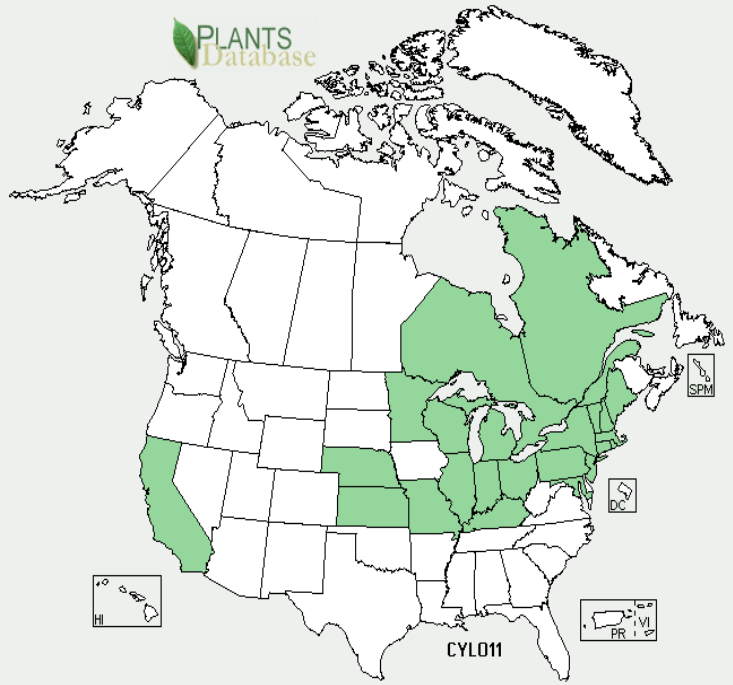
Biocontrol of *Vincetoxicum* spp. (Apocynaceae) with insects

USDA-ARS European Biological Control Laboratory
Montpellier, France
www.ars-ebcl.org

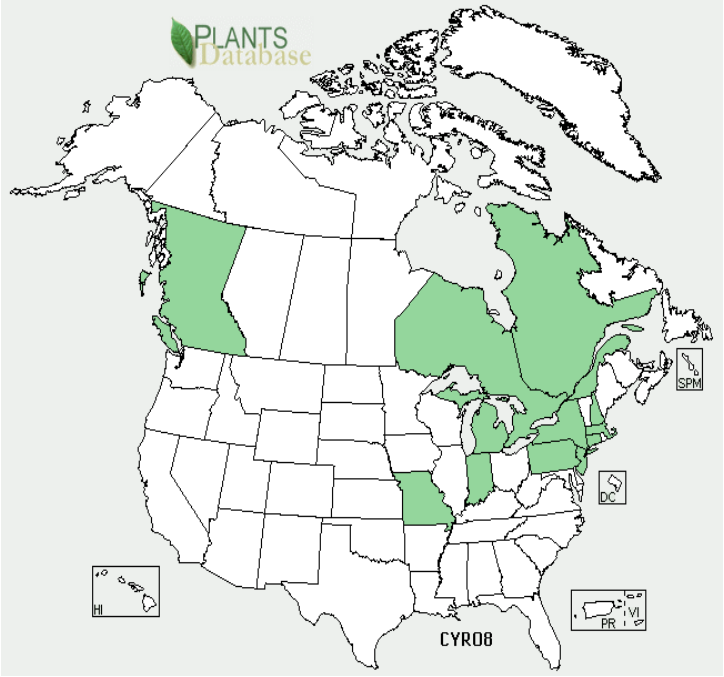
Distribution in the introduced range

Vincetoxicum nigrum

Vincetoxicum rossicum



USA (CA, CT, IL, IN, KS, KY, MA, MD, ME, MI, MN, MO, NE, NH, NJ, NY, OH, PA, RI, VT, WI),
CAN (ON, QC)



USA (CT, IN, MA, MI, MO, NH, NJ, NY, PA),
CAN (BC, ON, QC)

Potential Biocontrol Agents

Diptera

Contarinia vincetoxici

Euphranta connexa

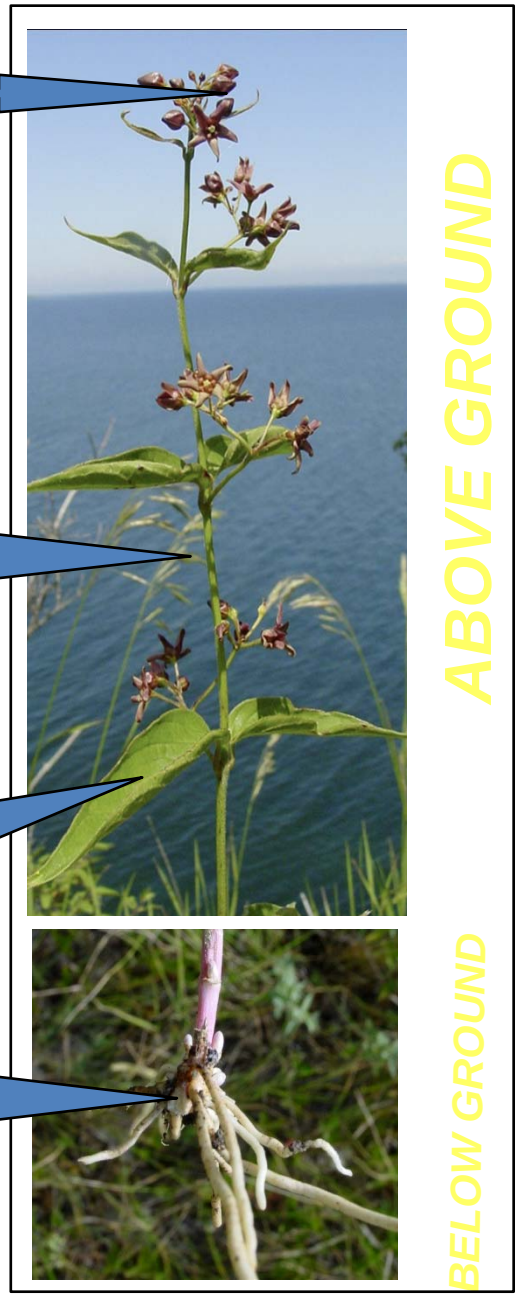
Lepidoptera

Hypena opulenta

Abrostola asclepiadis

Coleoptera

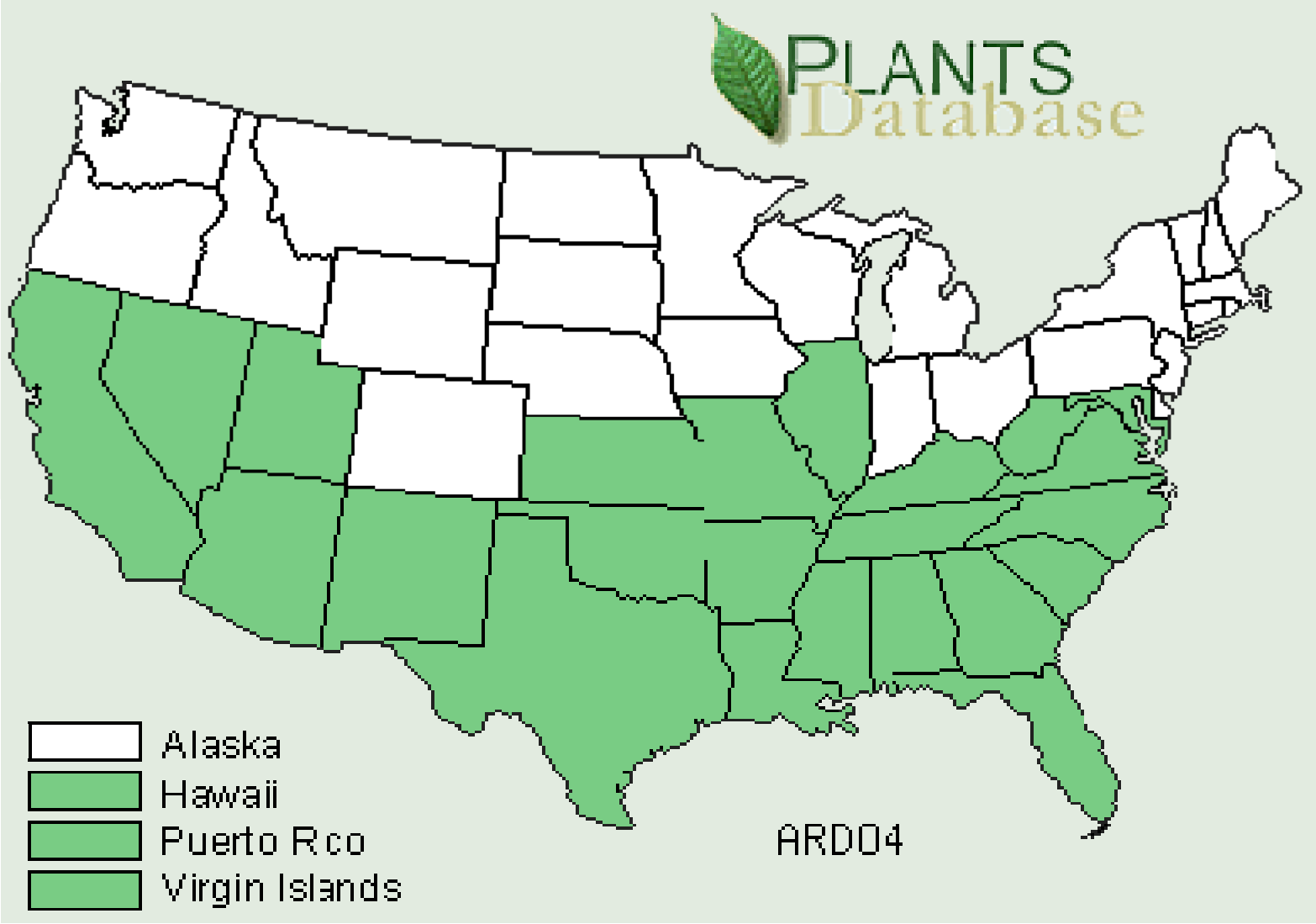
Chrysochus asclepiadeus



Biological control of *Arundo donax*: a practical solution

[1]KIRK, A. A., [2]GOOLSBY, J. A.
[1]EBCL, USDA/ARS, Montpellier,France
[2]USDA/ARS, Weslaco, Texas

Distribution of *A. donax* in the USA.



(USDA National Resources Conservation Service)

Why is *Arundo donax* a problem in north America?

- Invades riparian corridors
- Reduces biodiversity
- Dense stands are wildfire risk
- Depletes water resources
- Eradication costs $22000-46000/Ha
- Lack of natural enemies

Biological control of *Arundo* : a practical management solution?

- No close relatives in north America
- Several potential host specific organisms
- Excellent cooperative network to collect, test, select and release organisms
- Much cheaper than current removal costs
- Long-term impact on *Arundo* resulting in reduced invasiveness and area of infestation

Arundo donax insects selected from Europe for biocontrol of _Arundo_ in the USA

DIPTERA

Chloropidae

***Cryptonevra* spp. * Testing in USA**

Cecidomyiidae

***Lasioptera donacis* Coutin * Testing in USA.**

HYMENOPTERA

Eurytomidae

***Tetramesa romana* (Walker)* introduced to USA**

HOMOPTERA

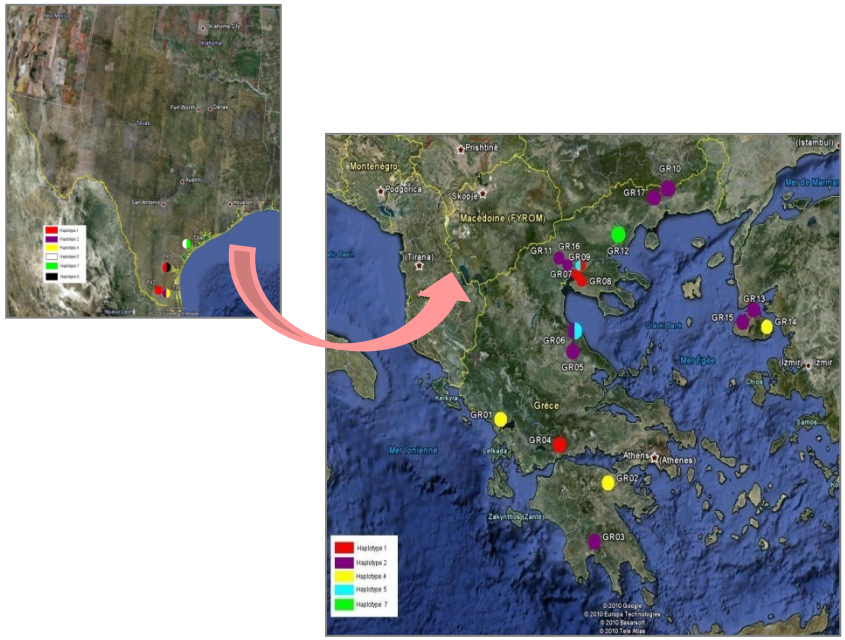
Diaspididae

***Rhizaspidiotus donacis* (Leonardi)* introduced to USA**

Solanum elaeagnifolium Cavanilles (Solanaceae)

- A weed native from Subtropical America
- Invasive in 28 countries over the world including Greece
- A threat to Agriculture, Human Health, and toxic to livestock

- ✓ Tracing the origin of the invasive populations
- ✓ Determining the level of genetic variation in introduced range relative to the native ones
- ✓ Both issues are vital to conducting a rigorous biological control program in Greece



Results by using Chloroplast DNA intron sequences and population genetic markers suggest:

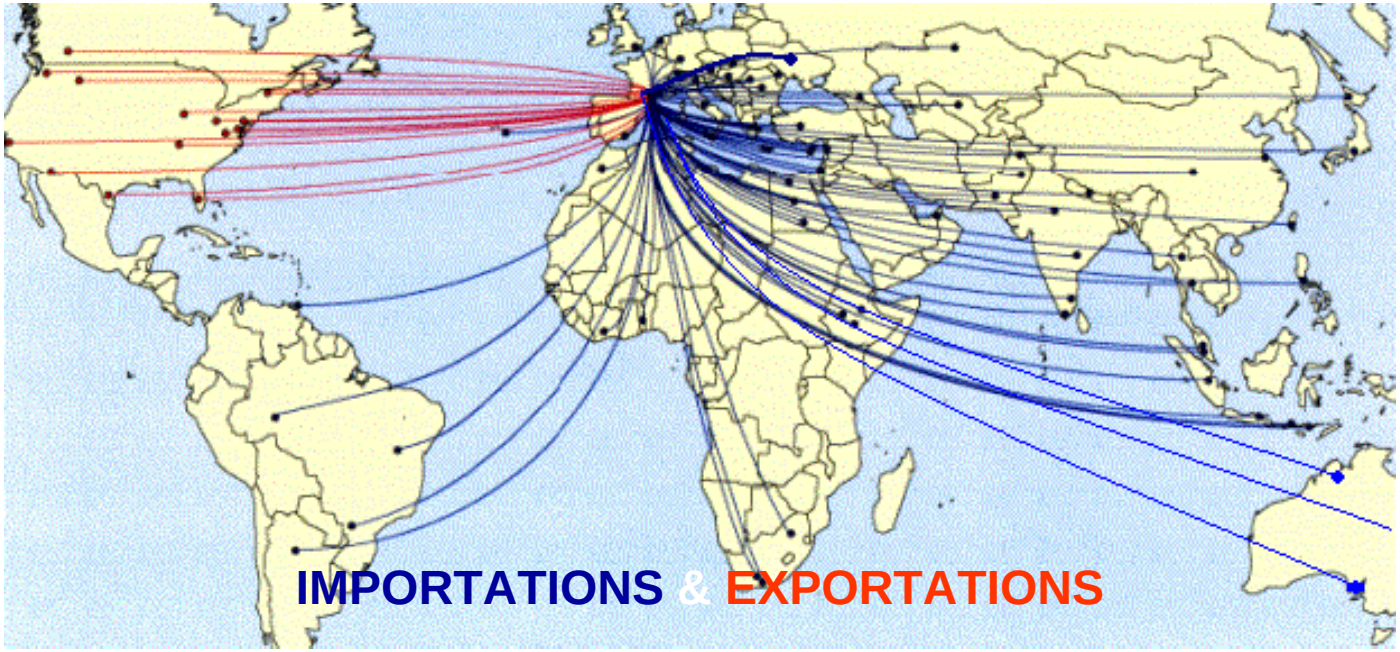
- ➢ A texan origin of the invasive populations in Greece
- ➢ A relatively high level of genetic diversity in Greece
- ➢ A scenario of multiple introduction events or a few numbers of introduction events with a large number of founders

For more information, please contact Marie-Claude Bon at mcbon@ars-ebcl.org

European Biological Control Laboratory

IMPORTATIONS AND EXPORTATIONS

Import. Insect and Plant Pests and Biocontrol Agents



Export. Biocontrol Agents

EBCL QUARANTINES

Quarantine activity certified by French authority

PATHOGENS OF INSECT PESTS & WEEDS
25 m²

CONTROL OF:
SOLID EFFLUENTS
LIQUID EFFLUENTS
AIR

INSECT PESTS, WEEDS & NATURAL ENEMIES
149 m²

EUROPEAN UNION – 27 COUNTRIES

FRANCE
GERMANY
BELGIUM
NEDERLAND
LUXEMBOURG
ITALY
EIRE
UNITED KINGDOM
SPAIN
GREECE
DENMARK
SWEDEN
FINLAND
AUSTRIA
PORTUGAL
HUNGARY
POLAND
CZECH REPUBLIC
SLOVAKIA
SLOVENIA
ESTONIA
LITHUANIA
LATVIA
MALTA
CYPRUS
BULGARIA
ROMANIA

International Conventions

EU legislation

French legislation

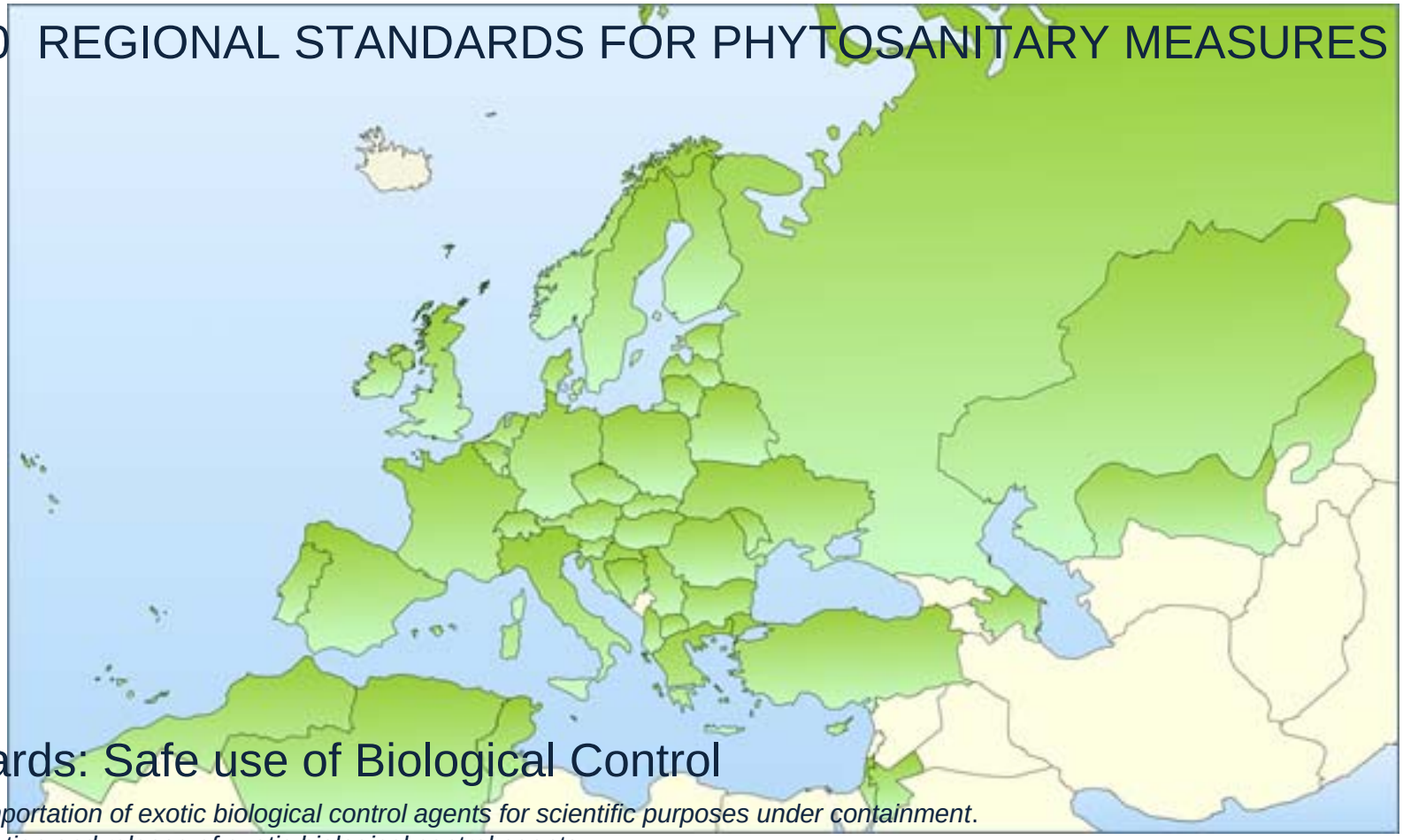
Agriculture
Plant Protection

Environment
Biodiversity

EPPO REGION

European and Mediterranean Plant Protection Organization
1951
50 MEMBERS

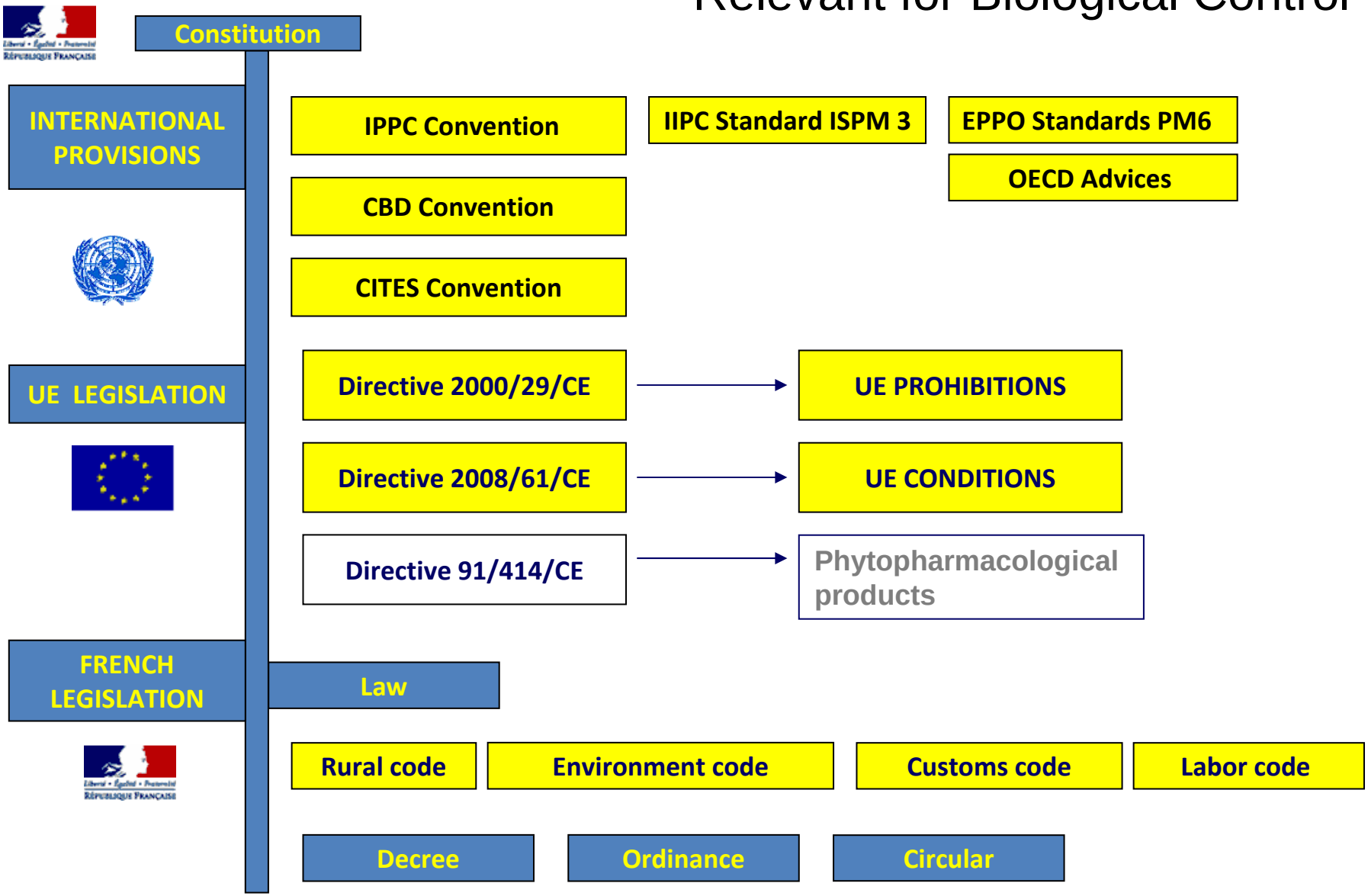
10 REGIONAL STANDARDS FOR PHYTOSANITARY MEASURES



EPPO Standards: Safe use of Biological Control

PM 6/1(1) 1999. First importation of exotic biological control agents for scientific purposes under containment.
PM 6/2(1) 2000. Importation and release of exotic biological control agents
PM 6/3(2) 2008. List of biological control widely used in the EPPO region.

LEGAL PACKAGE
Relevant for Biological Control



©

EXPLORATIONS IN MOROCCO FOR THE SEARCH OF BIOLOGICAL CONTROL AGENTS IN THE GENUS PERISTENUS (HYMENOPTERA: BRACONIDAE) FOR THE BIOLOGICAL CONTROL OF LYGUS Spp. (HEMIPTERA: MIRIDAE) IN NORTH AMERICA

COUTINOT D., TALEB A., ARAHOU M., BON M-C., MATOCQ A

2007 - 2010

7ème Congrès de l'Association Marocaine de la protection des plantes, Rabat, Maroc. 26 – 27 mai, 2010

© Dominique COUTINOT

NORTH AMERICA

- ***Lygus lineolaris*** (Palisot de Beauvois)
- ***Lygus hesperus*** Knight
- **Pests: seed alfalfa, cotton, &fruits including strawberries**.

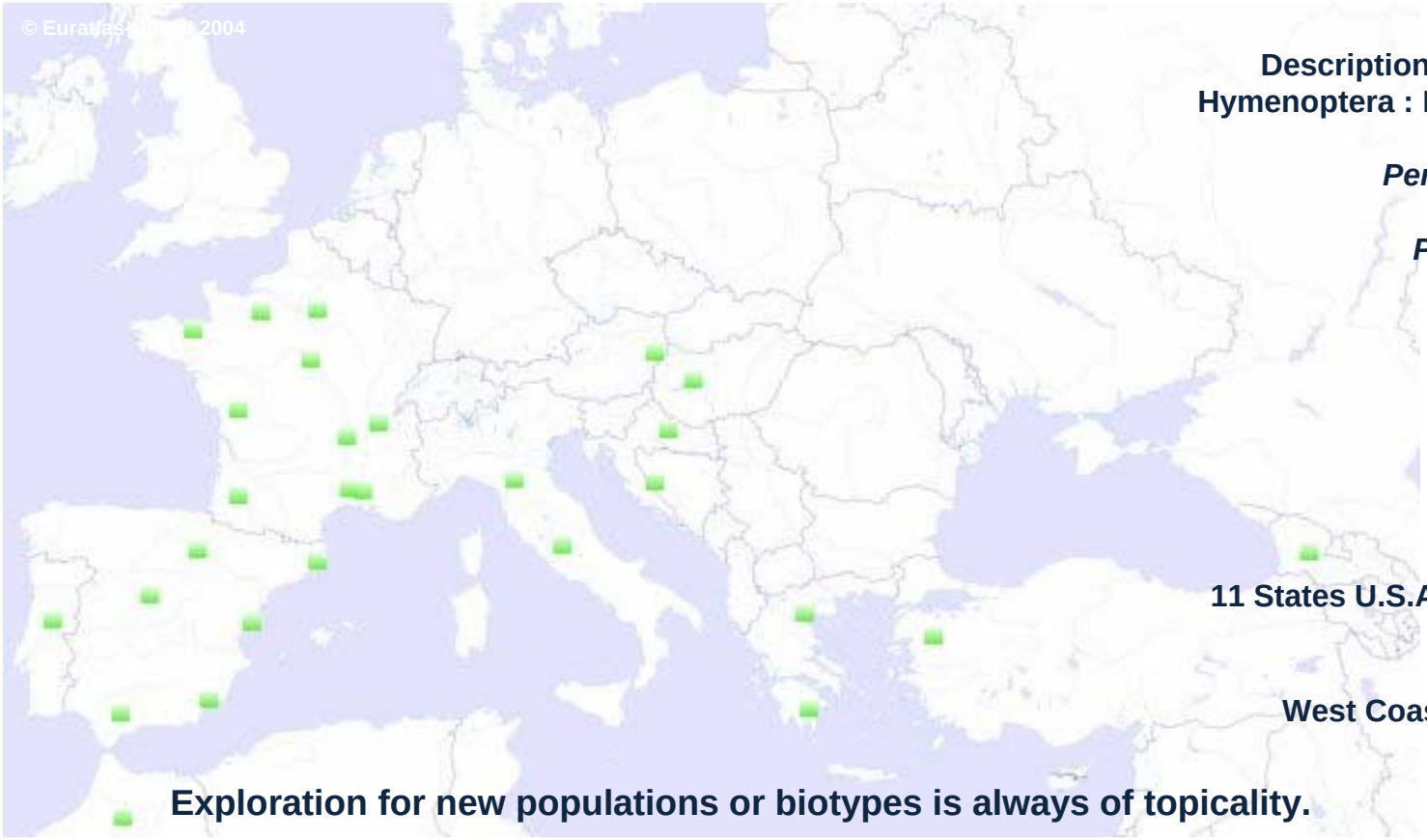
- **In the U.S. *L. lineolaris* losses and costs for the control: 2 to 3 billion US $ / year**

- **In California *L hesperus* damage 30 million US $ to cotton 40 million US $ to strawberries each year**

FUESTER *et al*., 2004 ***Proceedings of the 15th International Plant Protection Congress***
PICKETT *et al*., 2007 ***Biocontrol Science and Technology***

EXPLORATIONS IN EUROPE

Medicago sativa L. (Fabaceae)
Chenopodium album L. (Chenopodiacae)



Description of nymphal parasitoids:
Hymenoptera : Braconidae : Euphorinae

Peristenus digoneutis **Loan**
P. relictus **(Ruthe)**
P. rubricollis **(Thompson)**

Parasitism: 10 – 60 %

East Coast of the U.S.A.
Peristenus digoneutis Loan
11 States U.S.A. - 3 provinces in Canada.
Parasitism: 65% alfalfa

West Coast of the U.S.A. California
P. digoneutis & *P. relictus*
Sacramento 90% alfalfa
P. relictus
Monterey Bay 60% strawberries

Exploration for new populations or biotypes is always of topicality.

DREA *et al.*, 1973 *Environmental Entomology*
HEDLUND 1987 *U.S. Department of Agriculture, Agricultural Research Service, ARS-64*
COUTINOT et HOELMER 1999 *5th International Conference on Pests in Agriculture, Montpellier, France*
COUTINOT *et al.*, 2005 *AFPP - 7th International Conference on Pests in Agriculture, Montpellier, France*
COUTINOT *et al., 2008 2d International Conference on Biological Diversity of Invertebrates in cultivated Zones and Forests, Algiers, Algeria*
COUTINOT et al., 2010 *7th Moroccan Plant Protection Congress, Rabat, Morocco*

Explorations 2007-2010

Carried out in close collaboration with scientific authorities

&

in accordance with the law relating to the protection and the development of the environment (2003) into force in Morocco.

Ministry of Agriculture, Development and Fisheries
Plant Protection Service and Integrated Pest Management

Scientific Institute – Research Zoology and Animal Biodiversity Laboratory

Agronomic Institute Hassan II - Department of Plant Ecology

Explorations 2007 – 2010 in Morocco

- Access to resource

Legislation

- Collection, detention, export are subjected to conditions (dead or alive material)

Cooperation

- with authorities Agriculture – Environment and scientific community

- Results

First mention

- Larval populations of Miridae (15,000)
- *Peristenus relictus* in North Africa
- From *Lygus* and *Creontiades*
- *P. relictus* released in 2009 in the U.S.
  California, New Mexico, New Jersey, Delaware

- Benefits sharing

Cooperation

- New data - New species
- Reports – Publications – Congress
- BC Training

Collections, Importations, Exportations, Use of BC Agents

Plant Protection – Agriculture – Biodiversity - Environment

European Biological Control Laboratory

EBCL-USDA-ARS

Montpellier, France (EU)

Country of Origine

Collections - Exportations

Releases by a 3^{d} Country

Collection Permit

Export Permit

Letter of Authority Permit

or Declaration of Importation

Phytosanitary Certificate

CITES Declaration

Release Authorization

Release Permit

French agreements

Under specific conditions

Quarantine Activity Certified

Quarantines: 170 m^2

Importations

Insects - Plants

Known loader Security program

Exportations

Living Beneficials

Import – Export

French customs

FEDEX

Country of Origine

U.S. Cooperators

U.S. Agriculture

Benefits sharing

Scientific Collaboration

Knowledge of Legislation

New Data

New Species

Reports

Scientific Papers

Reduction of Pests **$**

Under International Conventions, Legislation and Regulations in force in European Union, France and Country of Origine

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PROSPECTING BIOLOGICAL CONTROL AGENTS ABROAD FOR REAL

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IS IT STILL POSSIBLE?

YES, under conditions!

Thanks to

Fernando Consoli for the invitation

Dan Strickman USDA-ARS
Acting Director,
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Ladislau Martin Neto
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Thank you for your attention...

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