"Nagoya protocol on Access and Benefit Sharing": The End of Biological Control?

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IOBC Commission "Biological Control and Access and Benefit-Sharing"

IOBC
OILB

Scope of presentation

- Biological control: what has been achieved?
- First phase of regulation: Import and Release of natural enemies
- Second phase of regulation: Access and Benefit Sharing, the Nagoya protocol and its effects
- How to proceed with biological control?

Biological control:
the use of an organism to reduce populations of another organism

Biological control: where does it work?

Everywhere where plants grow: also in natural ecosystems
Without biological control: no green earth !!

Biological control: where does it work?

Also in all agricultural areas,
controls majority of potential pests free of costs

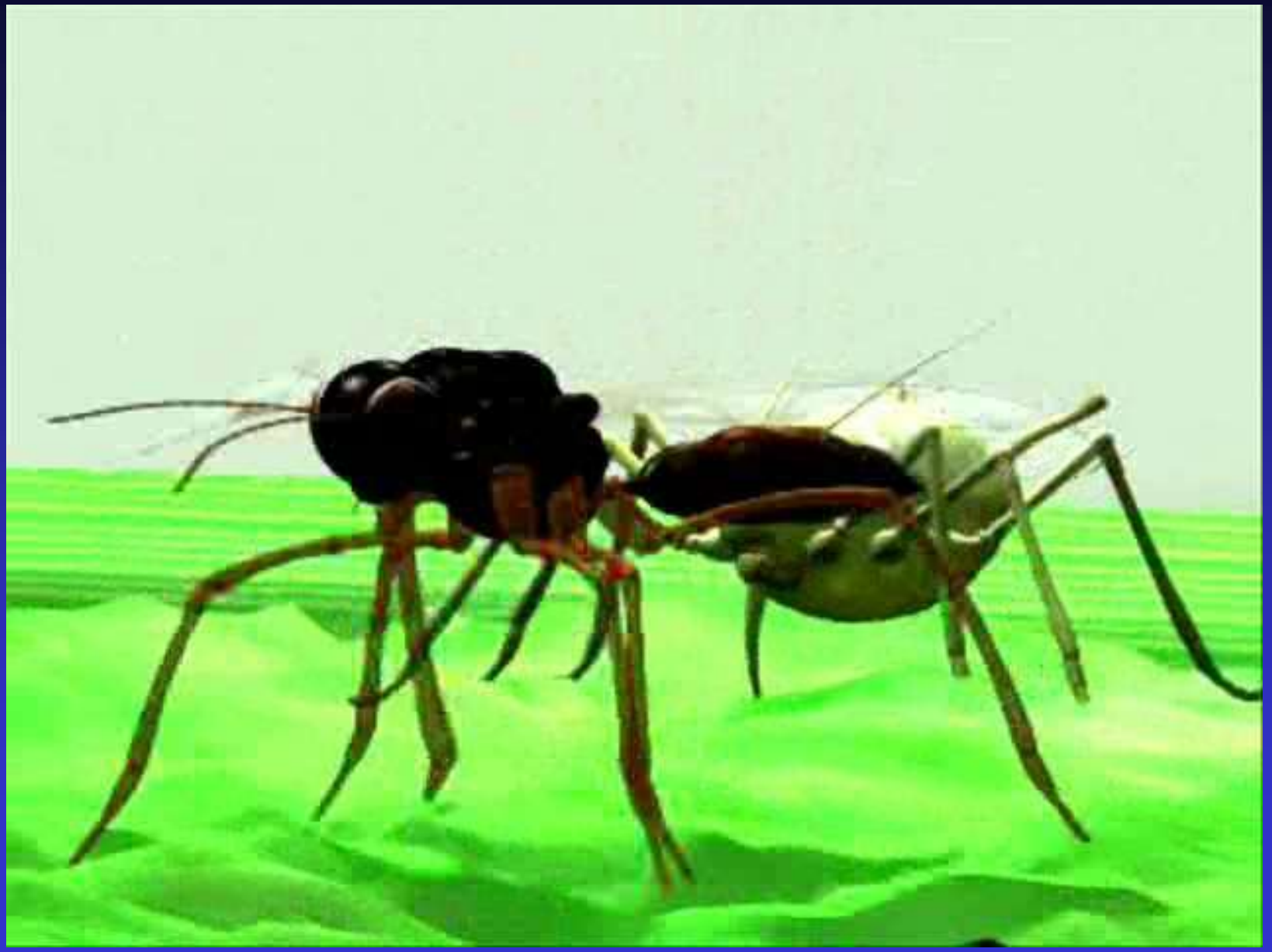
Biological control: the use of an organism to reduce populations of another organism

Three types of natural enemies:

- Predators (used for > 10.000 years)
- Parasitoids (used since 1880s)
- Pathogens (used since 1880s)

Biological control: predators

Biological control: parasitoids



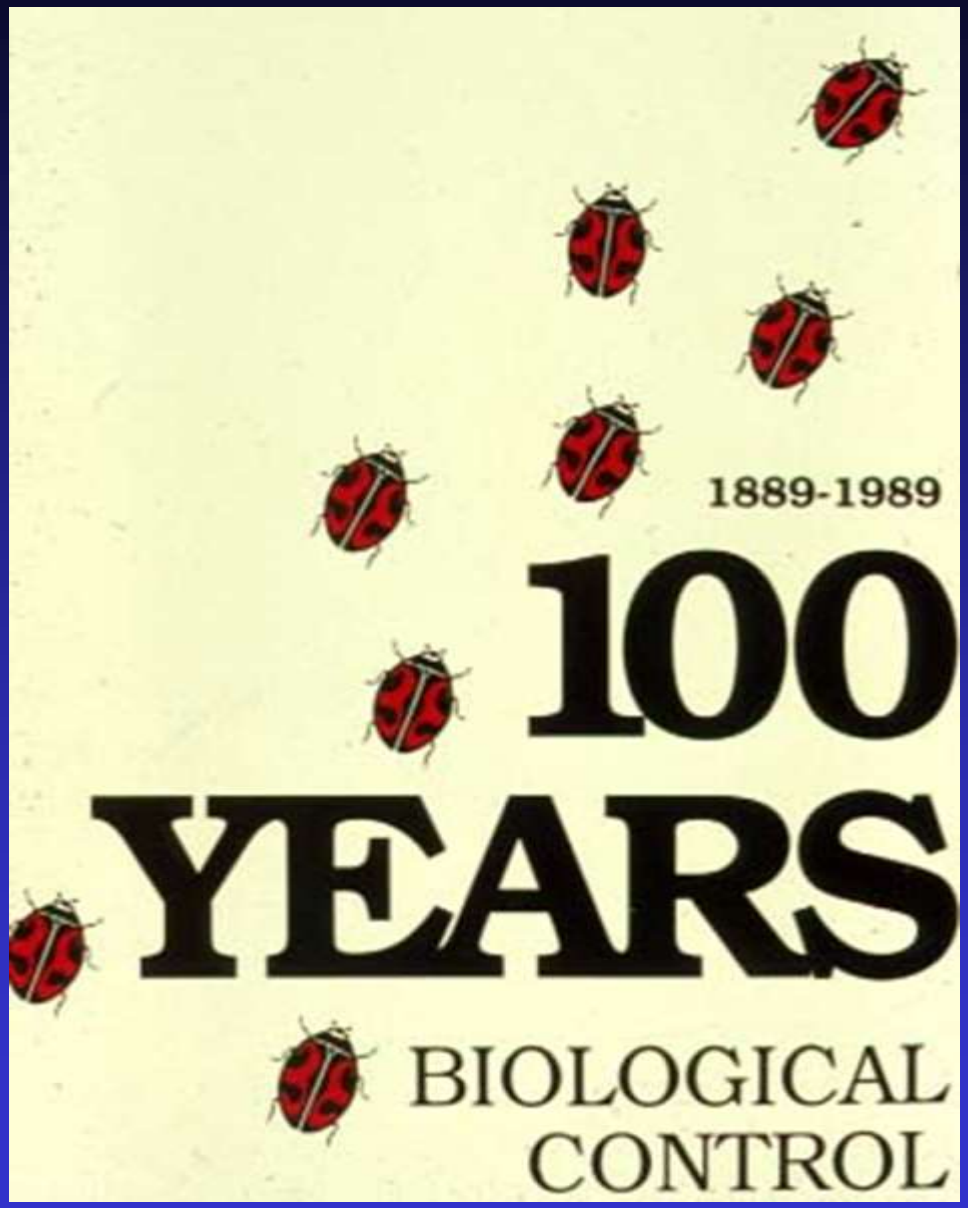
Biological control: pathogens

Biological control

Two main types:

- Classical = inoculation biological control
- Augmentative = inundative biological control

Classical Biological Control



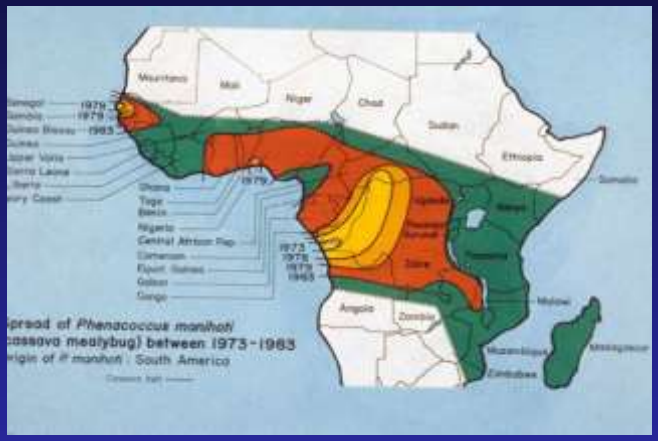
Rodolia beetle controls *Icerya* scale pest on citrus

- worldwide
- for more than 100 years
- in more than 50 countries

Cock et al. 2010

Classical Biological Control: two more examples

- Cassava mealybug native to Latin America, not a pest
- Accidentally imported in Africa, spread quickly, serious pest



Classical Biological Control: two more examples

- Cassava mealybug native to Latin America
- Accidentally imported in Africa, spread quickly

- Natural enemy survey Latin America
-
- Promising species introduced to Africa 1970s

- Permanent control all tropical Africa

Cock et al. 2015

Classical Biological Control: two more examples

- Giant Salvinia weed originally from Latin America
- Invasive weed in lakes in many countries worldwide

Classical Biological Control: two more examples

- Giant Salvinia weed originally from Latin America
- Invasive weed in lakes in many countries worldwide

- Salvinia beetle from Latin America introduced into Australia, United States, India, Kenya, Malaysia, Namibia, New Guinea, South Africa, Sri Lanka, Zambia

- Complete control

Winston et al. 2014

Classical Biological Control: how we work

1. Find country of origin of pest
2. Look for natural enemies
3. Import and release safe and potentially effective candidates
4. If biocontrol agent controls pest, it will do so forever

Classical Biological Control: what we achieved

- > 6,000 introductions
- with 2,400 different species of natural enemies
- against 600 pest species
- in 150 countries

Classical Biological Control: what we achieved

- > 6,000 introductions
- with 2,400 different species of natural enemies
- against 600 pest species
- in 150 countries

- 30 % of introductions led to establishment
- 10 % resulted in satisfactory control
- of 170 different pest species

- Remarkably better success ratio than chemical control

Cock et al. 2016

Classical Biological Control: cost:benefits

Cassava mealybug project in Africa

Cost:benefit ratios over 40 years of 1: 200–1700

And increasing every year (no more inputs, permanent control)

Remarkably better cost:benefit ratio than chemical control (1:3)

Cock et al. 2015

Augmentative Biological Control: how we work

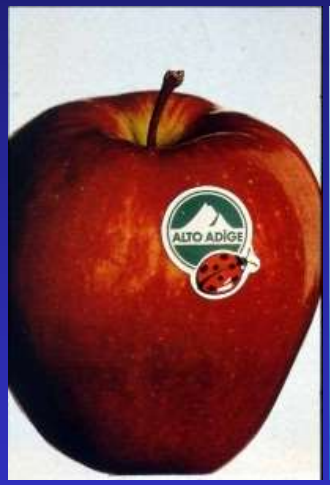
Augmentative Biological Control (ABC): release of mass produced natural enemies (native or exotic) to control pests (native or exotic)

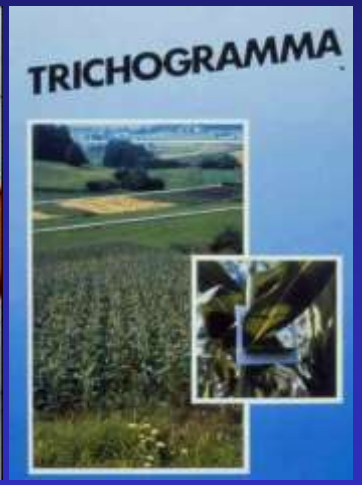
1. Collect and evaluate natural enemies
2. Mass rear them
3. Release them in large numbers for immediate control effect

Augmentative Biological Control: what we achieved

> 30 Million hectares worldwide under ABC

Main crops with ABC: fruit orchards, maize, cotton, sugarcane, soybean, vineyards, greenhouse crops ...





Augmentative Biological Control: what have we achieved

440 species of biocontrol agents commercially available since 1970

Augmentative Biological Control: what have we achieved

From "cottage industry" to large professional producers

Mass production, storage, transport and release methods

Quality control

Guidance for farmers

Appreciated by farmers and consumers

Augmentative Biological Control: example simple system

Brazil, sugarcane borer in sugar cane

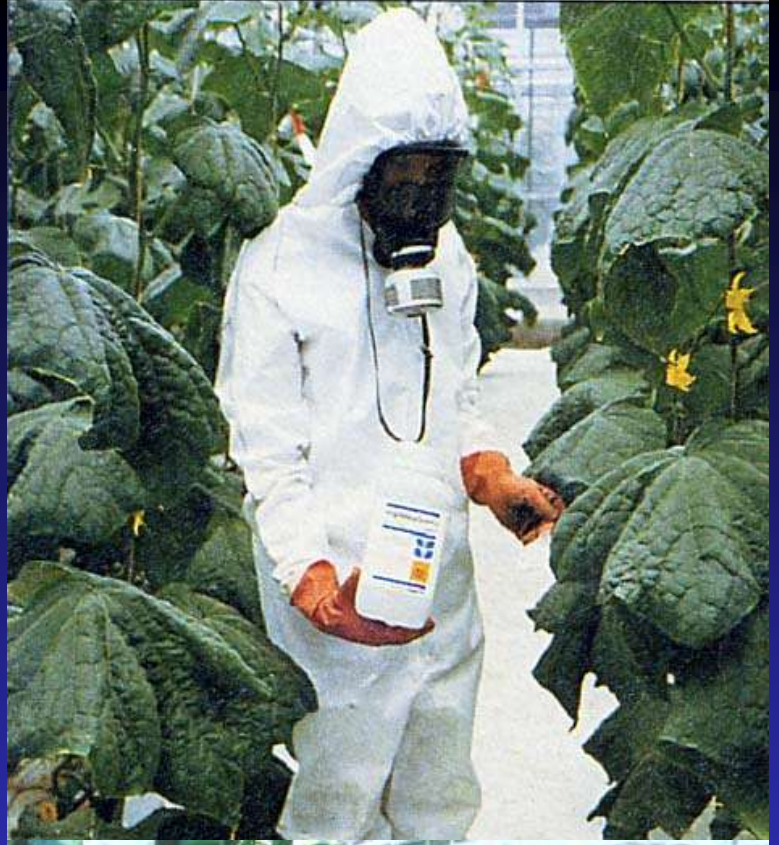
Mass production and release of
Cotesia flavipes (origin Asia) on
> 3 million hectares/year

Augmentative Biological Control: less simple system
My experimental area: 2500 ha glasshouses all biocontrol

Modern glasshouses: modern pest management, 10-20 different biocontrol agents in tomato

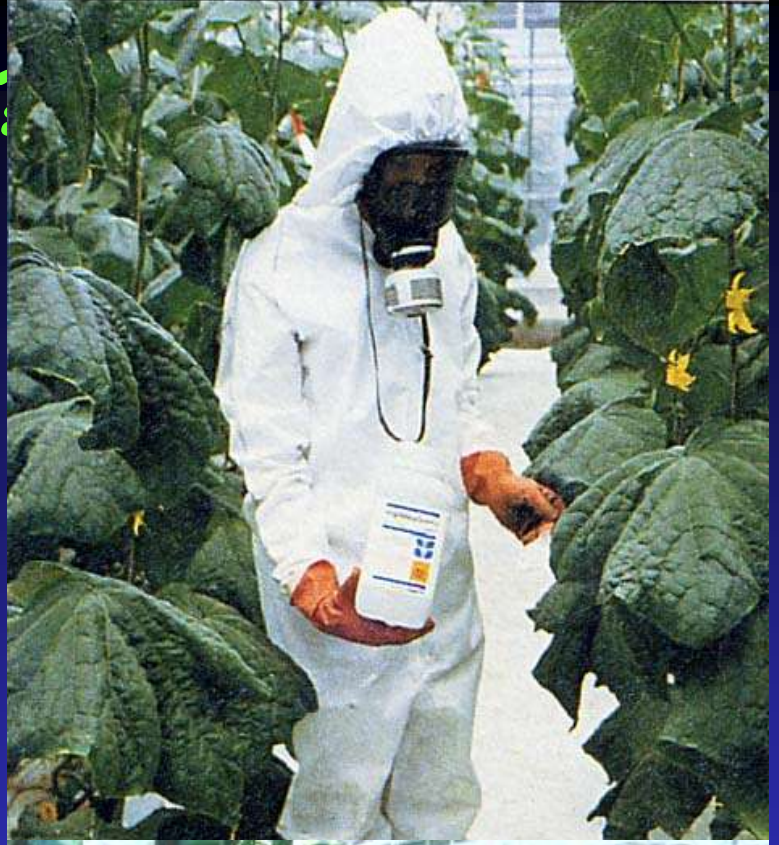
ABC amazing achievements: why

- Safer for farm workers, consumers and environment, a pleasure to apply
- Farmer can always harvest: no re-entry period like with chemical pesticides
- Release of natural enemies early in season, long-term control



ABC amazing achievements: why?

- Safer for farm workers, consumers and environment, a pleasure to apply
- Farmer can always harvest: no re-entry period like with chemical pesticides
- Release of natural enemies early in season, long-term control
- No phytotoxic effects on (young) plants, higher yields
- Biocontrol is permanent, no resistance development: once a good natural enemy always a good natural enemy
- Better price, export incentive



Biological Control: 2017

INSECTS

VIRUSES

MITES

VERTEBRATES

NEMATODES

BACTERIA

FUNGI

DISEASES

WEEDS

Scope of presentation

- Biological control: what has been achieved
- First phase of regulation: Import and Release of natural enemies
- Second phase of regulation: Access and Benefit Sharing, the Nagoya protocol and its effects
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Biocontrol regulations: why?

First 100 years of biocontrol few rules concerning import of exotic agents: clean samples

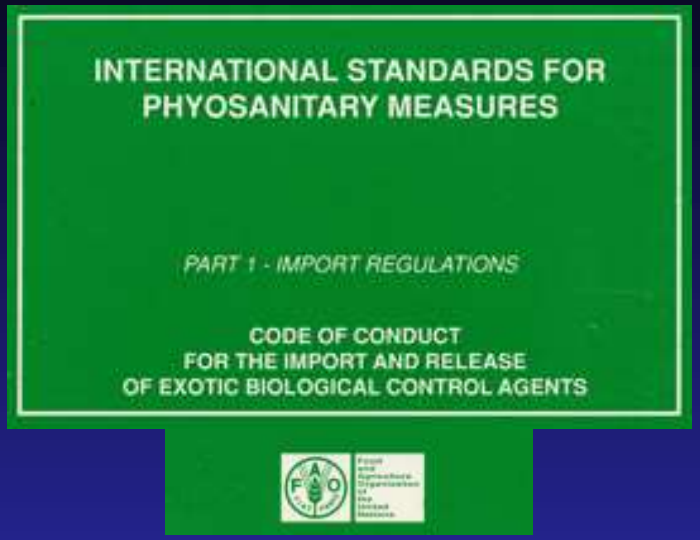
Researchers were careful: prevent side effects

Popularity of biological control in 1970s resulted in increased release of exotic organisms

Need to design procedures to prevent mistakes

First proposal FAO and IOBC

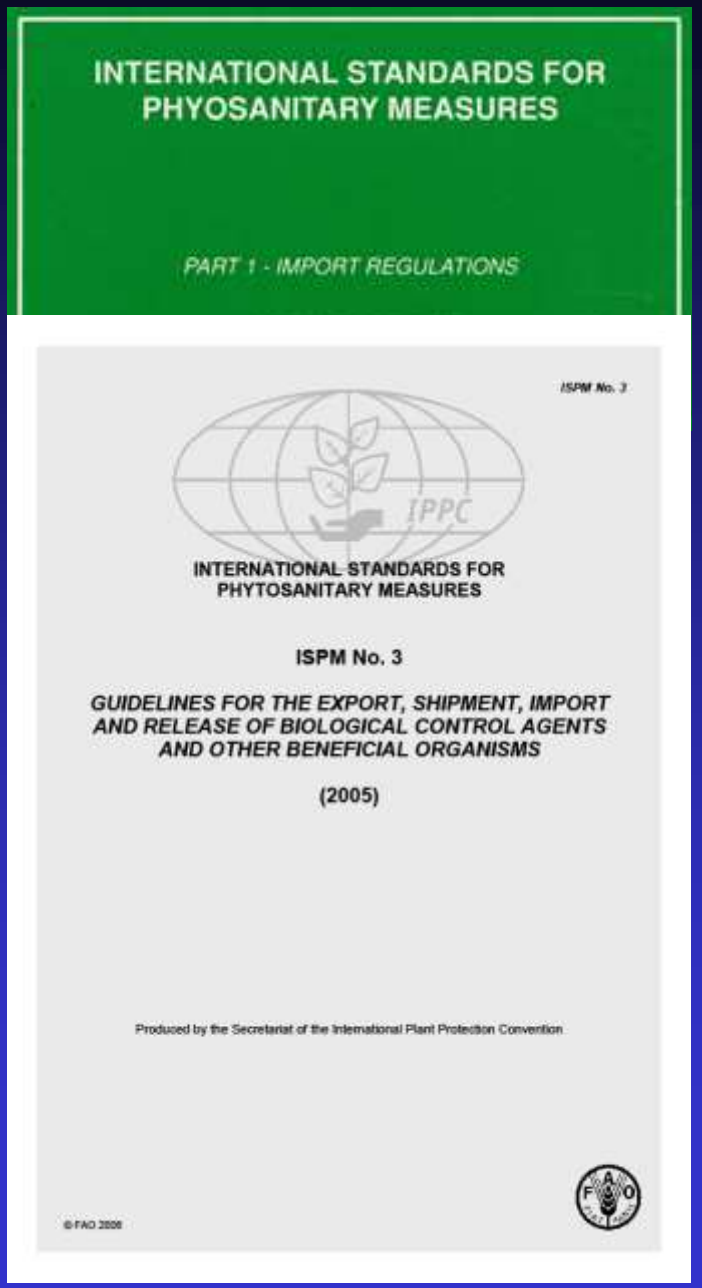
1. 1995: FAO + IOBC + CABI Code of Conduct for Import and Release of Biological Control Agents



First phase of regulation: FAO and IOBC

1. 1995: FAO + IOBC +CABI Code of Conduct for Import and Release of Biological Control Agents

2. Updated in 2005



Next IOBC / OECD studied all existing regulations and guidelines

Found the following general aspects:

1. Characterization of natural enemy (taxonomy, biology)
2. Human health risks (limited info needed)
3. Environmental risk assessment (main consideration)
4. Efficacy (significant reduction of pest population)

Resulted in an OECD/IOBC general framework for a qualitative risk assessment (Anonymous, 2004 via www.oecd.org)

Next, an IOBC Commission:

- Merged previous documents of FAO, IOBC, and OECD
- Kept four steps: characterization of organism, human health risks, environmental risk, and efficacy;
- But made risks assessment quantifyable and more simple: hierarchical, early decision bad agent, safe money

5 Sep 2005 19:10 AR ANRV263-EN51-25.tex XMLPublish[SM](2004/02/24) P1: KUV
AR REVIEWS IN ADVANCE10.1146/annurev.ento.51.110104.151129
(Some corrections may occur before final publication online and in print)

Annu. Rev. Entomol. 2006. 51:609–34
doi: 10.1146/annurev.ento.51.110104.151129

First published online as a Review in Advance on September 7, 2005

ASSESSING RISKS OF RELEASING EXOTIC BIOLOGICAL CONTROL AGENTS OF ARTHROPOD PESTS

J.C. van Lenteren,[1] J. Bale,[2] F. Bigler,[3] H.M.T. Hokkanen,[4] and A.J.M. Loomans[5]

But situation concerning regulation of biocontrol agents worldwide is very confused

Regulations for biocontrol agents

Africa: from none to complicated

Central and South America: from none to very complicated

North America: reasonable

Asia Pacific: from none to very complicated

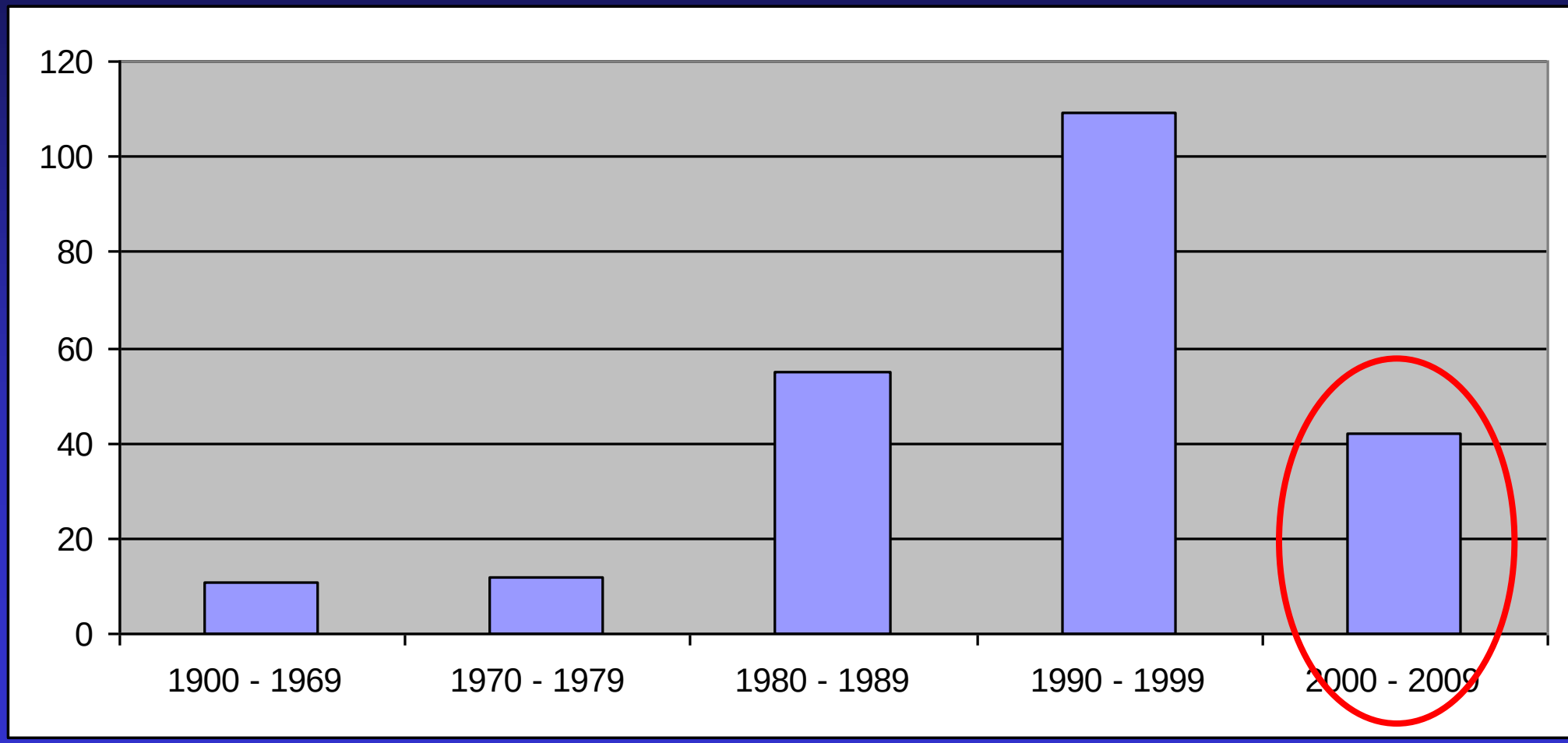
Europe: from none to very complicated

Regulation of biocontrol agents

Most biocontrol workers agree that FAO / IOBC guidelines are needed to prevent making mistakes

Result of these guidelines are a slow down of import of exotic biocontrol agents

Number of natural enemy species becoming available per time period of 10 years for ABC



Regulation of biocontrol agents

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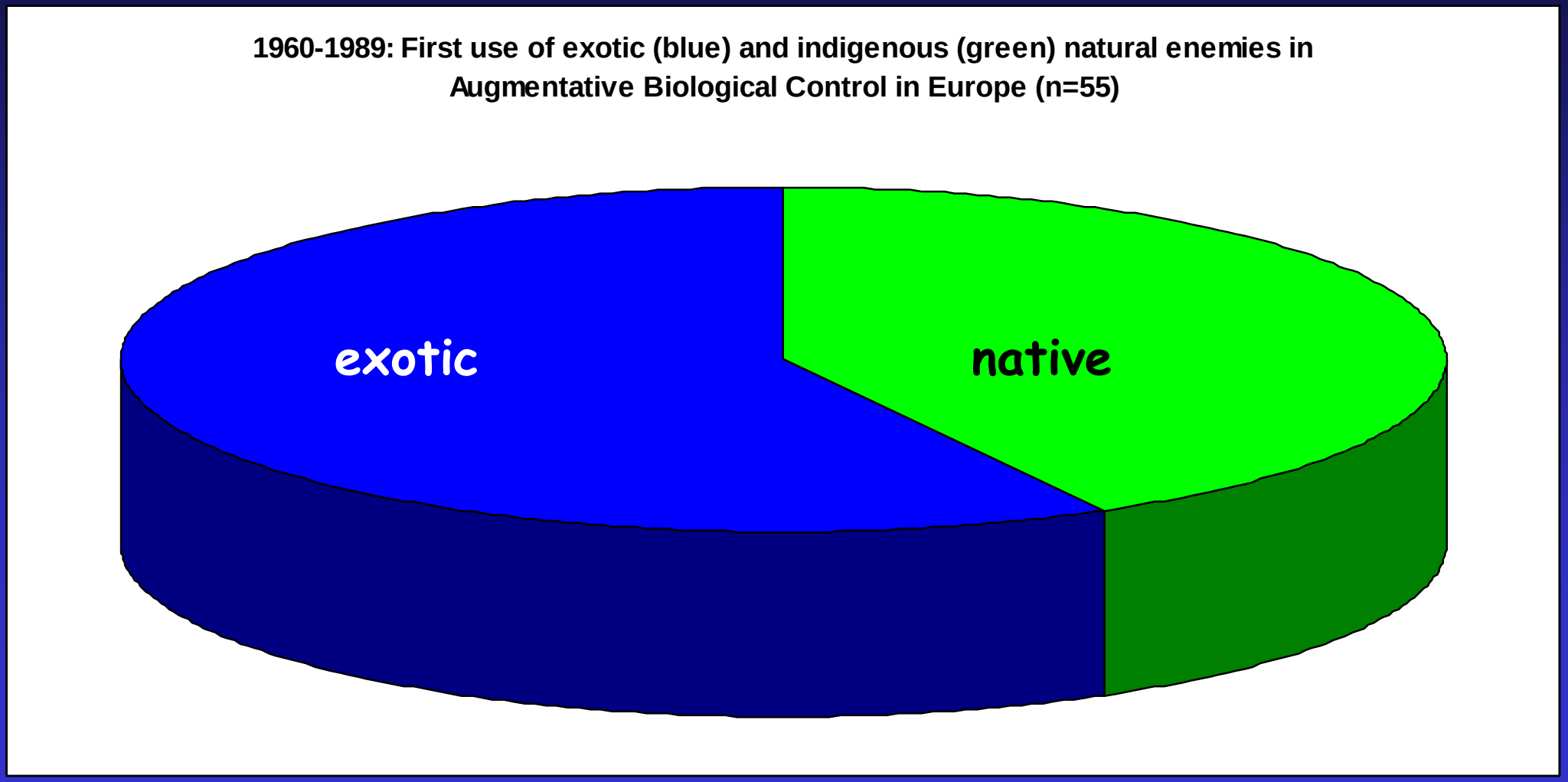
Result of these guidelines are a slow down of import of exotic biocontrol agents

Higher costs of exotic biocontrol agents

A dramatic shift in use from exotic to native biocontrol agents

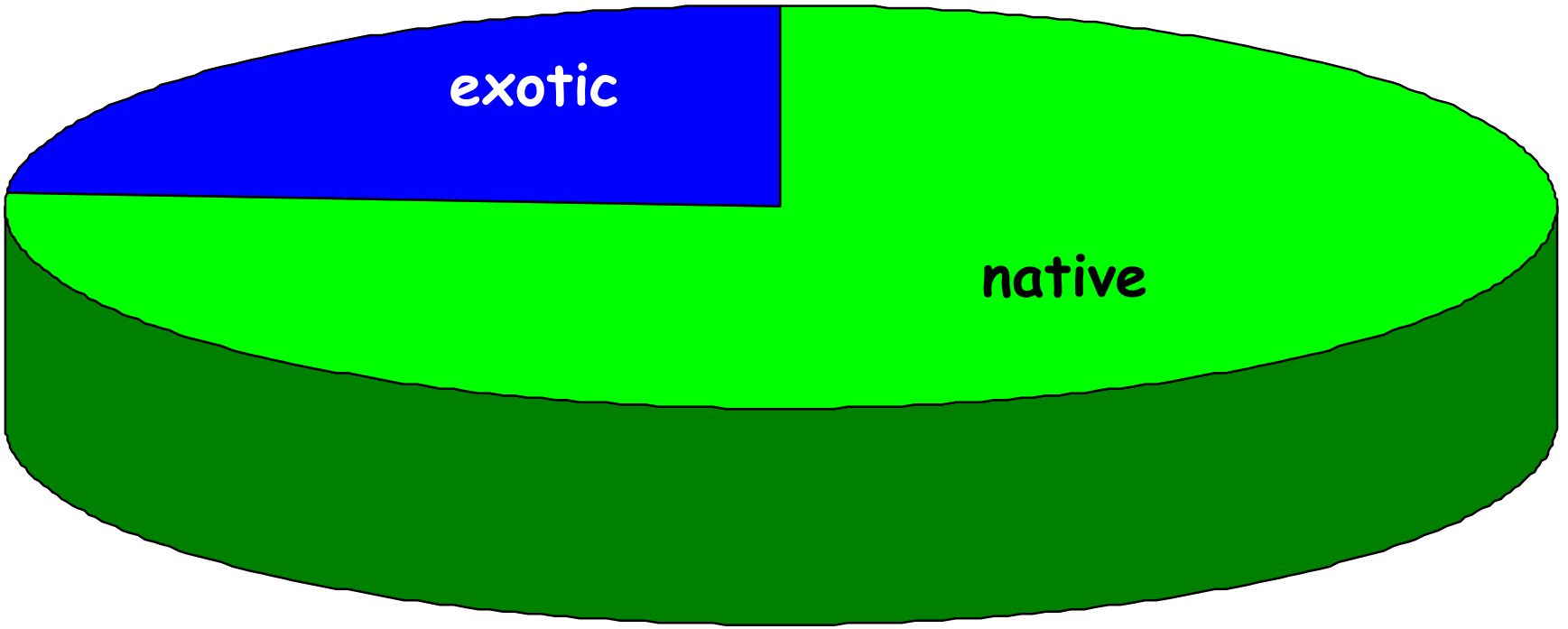
Before 1960 in Europe: ABC agents 100% exotic

Use of new ABC agents 1960 - 1989



Use of new ABC agents 2000 - 2009

2000-2009: First use of exotic (blue) and indigenous (green) natural enemies in Augmentative Biological Control in Europe (n=25)



Scope of presentation

- Biological control: what has been achieved
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First phase of regulations: make biological control better, prevent problems, increase confidence

Second phase of regulations NOT related to the science of biological control

Deals with the question:

Who owns biological control agents?

Who owns biological control agents?

The Magazine -India: **Insect Thieves**

25 August 2008: **BIO-PIRACY**

Scientists ….. are plundering our forests for rare insects that can be smuggled

SHRUTI RAVINDRAN

Who owns biological control agents?

Convention on Biological Diversity (CBD)

Entity of the UN created in Rio de Janiero, Brazil, 1992

States own their natural resources

CBD Nagoya Protocol

ARTICLE 1

Objectives of Protocol:

- conservation of biological diversity
- sustainable use of its genetic resourses
- fair and equitable sharing of the benefits, to be formulated in Access and Benefit Sharing (ABS) agreements

All biocontrol agents are genetic resources

CBD Nagoya Protocol

ARTICLE 15

Access to Genetic Resources will be determined by national governments

CBD Nagoya Protocol

ARTICLE 15

Access to Genetic Resources will be determined by national governments

To collect natural enemies, an agreement should be established about:

- access to genetic resources
- sharing of benefits arising from their use

between the parties involved (source country/region and recipient countries/organizations)

CBD Nagoya Protocol

CBD involved parties adopted a regime on Access and Benefit Sharing, the "Nagoya protocol", which came into force in Oct 2014

cbd.int/abs/doc/protocol/nagoya-protocol-en.pdf

Convention on Biological Diversity

CBD involved parties adopted a regime on Access and Benefit Sharing, the "Nagoya protocol", which came into force in Oct 2014

In 2008, IOBC Commission on Biological Control and ABS, aim to:

- provide CBD ABS parties with scientific info, and
- to design an ABS regime that ensures practical and effective managements for the collection and use of biocontrol agents which are acceptable to all parties.

FAO request to IOBC: provide info about BiCo

IOBC wrote report, summarized successes of biocontrol and explained potential problems caused by ABS regime

BACKGROUND STUDY PAPER NO. 47

October 2009

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منظمة الأغذية والزراعة للأمم المتحدة | 联合国粮食及农业组织 | Food and Agriculture Organization of the United Nations | Organisation des Nations Unies pour l'alimentation et l'agriculture | Продовольственная и сельскохозяйственная организация Объединенных Наций | Organización de las Naciones Unidas para la Agricultura y la Alimentación

COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

THE USE AND EXCHANGE OF BIOLOGICAL CONTROL AGENTS FOR FOOD AND AGRICULTURE

by

Matthew J.W. Cock, Joop C. van Lenteren, Jacques Brodeur, Barbara I.P.Barratt, Franz Bigler, Karel Bolckmans, Fernando L. Cônsoli, Fabian Haas, Peter G. Mason, José Roberto P. Parra[1]

Who benefit from biological control?

- **Farmers** - Free pest management, increased yields
- **Society** - Improved food security
  - Improved livelihoods
  - Reduced contamination from pesticides

Who benefit from biological control?

- **Farmers** - Free pest management, increased yields
- **Society** - Improved food security
  - Improved livelihoods
  - Reduced contamination from pesticides
- **Environment** - Reduced contamination from pesticides
  - Increased biodiversity
  - Better control of invasive alien species
- **Science** - Cooperative research developing / developed countries,
  - Education of young scientists in developing countries, establishment of expert centres

Other characteristics of biological control:

Biocontrol is a mutual trade worldwide

Countries providing biocontrol agents are also users of this technology, developing countries are provided with permanent, safe and free pest management

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Countries providing biocontrol agents are also users of this technology, developing countries are provided with permanent, safe and free pest management

Biocontrol is largely a non for profit affair

Biocontrol agents are different from other genetic resources (… seeds, chemical compounds for pharmaceuticals and pesticides …): no bio-piracy

Conclusions and follow up of report for FAO

Protocols should build on the existing multilateral practice of exchange of natural enemies for biocontrol, which ensures fair sharing of the benefits

ABS in relation to biocontrol should be based on non-monetary benefit sharing, as today practised by most organisations involved in biological control

IOBC just published draft agreement for use of biocontrol agents

BioControl
DOI 10.1007/s10526-017-9810-3

CrossMark

Best practices for the use and exchange of invertebrate biological control genetic resources relevant for food and agriculture

P. G. Mason · M. J. W. Cock · B. I. P. Barratt · J. N. Klapwijk · J. C. van Lenteren · J. Brodeur · K. A. Hoelmer · G. E. Heimpel

Open Access, free download at site of BioControl

Aims of IOBC design for ABS

To promote non-commercial research, such as research in taxonomy, ecology, and genetics

To maintain the environmentally sound and sustainable use of biocontrol agents

To provide a firm basis for cooperation,transparency, communication and trust between the parties to the Agreement, taking account of the concerns of both providers and users of biocontrol agents

IOBC design for ABS

Recognizes need to specify the terms for:

1. Access to organisms,
2. Their utilization in accordance with Prior Informed Consent (PIC),
3. Their possible transfer to third parties, and
4. For sharing the benefits resulting from their use

Agreement is based on mutually agreed terms (MAT) between provider and user

Agreement for use of naturally-occurring beneficial organisms

1. Access:

Specify conditions for access to the organisms,

a list of organisms likely to be collected;

a list of collected samples is presented to the Provider within XX months after sampling

Agreement for use of naturally-occurring beneficial organisms

1. Access:

Specify conditions for access to the organisms,

a list of organisms likely to be collected;

a list of collected samples is presented to the Provider within XX months after sampling

2. Use:

Biocontrol agents may be used for non-commercial purposes including for release into nature, academic research, collections, and teaching. Any commercialization is prohibited.

Any change from non-commercial to commercial use shall require a new Prior Informed Consent in writing issued by the Provider.

Agreement for use of naturally-occurring beneficial organisms

3. Transfer to third parties:

Transfer of the biocontrol agents for non-commercial activities is allowed if the User ensures that the subsequent Third Party is informed about the provisions under this Agreement and undertakes to pass on the biocontrol agents under the same obligations to any further recipient.

Agreement for use of naturally-occurring beneficial organisms

3. Transfer to third parties:

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This section of the agreement contains specific conditions to prevent unauthorized use and commercialization

4. Sharing benefits:

The agreement regulates the fair and equitable sharing of benefits that result from their use

Agreement for use of naturally-occurring beneficial organisms

4. Sharing benefits

Benefits include:

- Provider includes local researchers if such interest exist
- Publications etc. fully acknowledge source of the biocontrol agent
- Provider receives a copy of all publications
- Research results will be communicated to involved stakeholders in an adequate manner and to requirements of the Provider
- Duplicate specimens will be shared with the repository in the Provider country in accordance with good scientific practice

Agreement for use of naturally-occurring beneficial organisms

4. Sharing benefits

If the User, in the course of the research, discovers any unforeseen commercial potential of the IBCA(s), he/she is obliged to share such information with the Provider prior to any publication of such information

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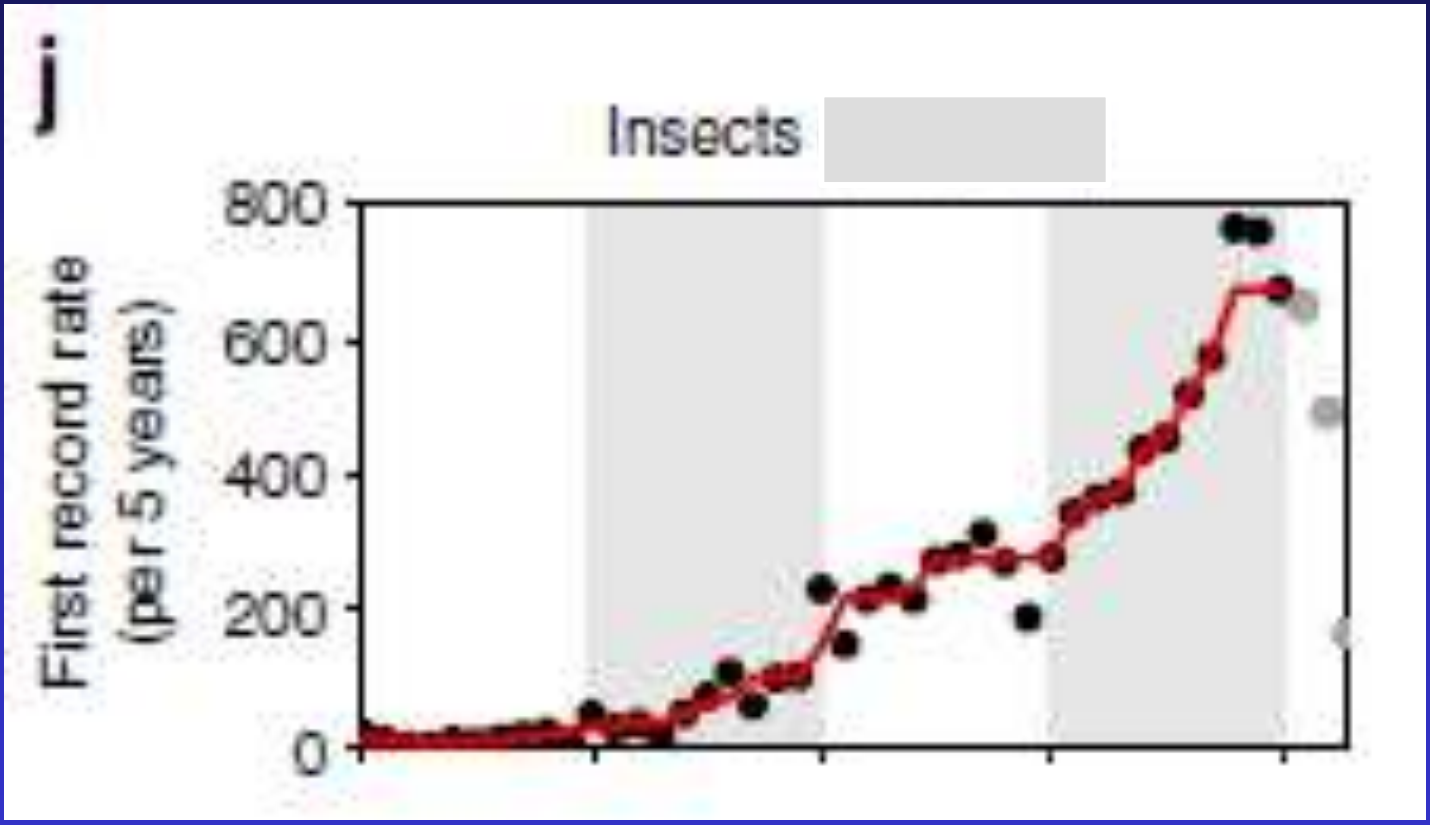
How to proceed with biological control ?

After ABS discussions started:

- Several countries prohibited collection of biocontrol agents, while they continued to accidentally export pests..



Seebens et al 2017
Nature communications

- Projects on hold/terminated while the number of invasive organisms is increasing exponentially

How to proceed with biological control ?

After ABS discussions started:

- Threat of law suits after publication of origin of biocontrol agents
- Biocontrol workers risk imprisonment when collecting

- Bureaucratic time consuming procedures to establish ABS agreements:
  NONE realized until now

Conclusions

Regulations concerning Risk Assessment of Biocontrol Agents delay import and release of exotic biocontrol agents

Countries without biocontrol expertise tend to over regulate

The Nagoya protocol resulted until now in termination of collection, import and release of exotic biocontrol agents

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Bureaucratic nightmare

Safest and most sustainable method of pest control in crisis

Chemical and Biological Control compared

	Chemical control*	Biological control
Number of ingredients tested	> 1 million	2,000
Success ratio	1 : 200,000	1 : 10 – 1,000
Developmental costs	400 million $	2 million $
Developmental time	10 years	10 years
Benefit / cost ratio	3 : 1	2.5/2,000 : 1
Risks of resistance	large	small
Specificity	very small	very large
Harmful side-effects	many	nil/few

* = data from chemical industry