IPM : the future is already here

Ilaria Pertot
FONDAZIONE EDMUND MACH

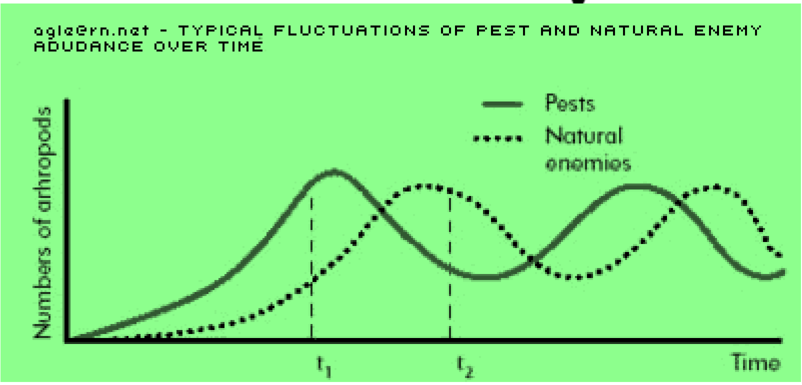
Andrea Lucchi
IN SUPREMÆ DIGNITATIS 1343

IOBC

www.iobc-wprs.org

Why do we need pesticides in modern agriculture?

In nature several mechanisms that control pests and pathogens exist, thus populations stay at balance



- **Intensification of modern agriculture : monoculture, high plant density, excess of nitrogen fertilization, etc.)**
  - Outbreaks of pests and diseases
- **Consumers: low acceptance of aesthetic damages**
- **Food retailers: high quality standards, long food shelf-life**
- **Growers: minimization of losses, because their profit margin is very low**
- **Pesticides are easy to use, very effective and most of the time very cheap**

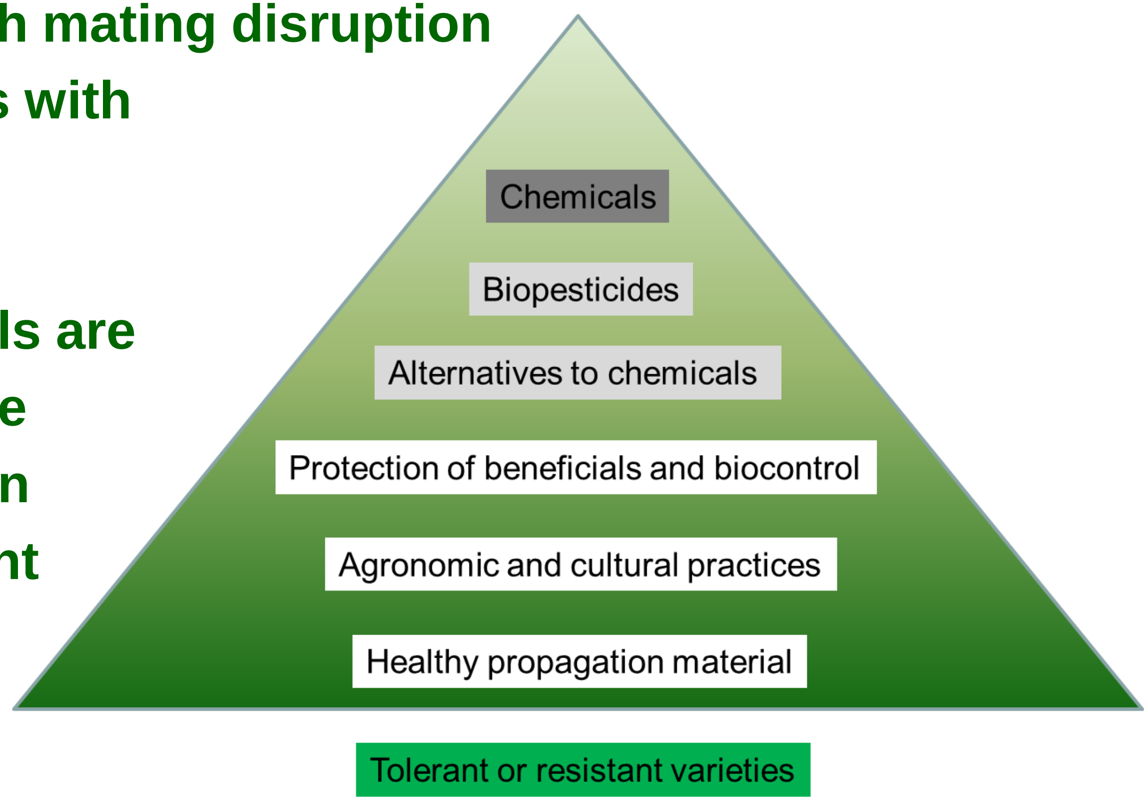
IPM is the sustainable solution for modern agriculture

- Most of the synthetic chemical pesticides have several disadvantages that are widely known (environmental pollution, health concerns, contamination of grown water, built up etc.)
- IPM was developed as the technical solution to prevent side effects of pesticides
- IPM is now a continuous improvement process of sustainable plant protection
- IPM is not ‘going back to the past’: researchers are looking at natural mechanisms of pest/pathogens control as a source of new innovative tools to be provided to growers
- Not only the classical biocontrol of insects, but also microbial and botanical biopesticides, resistant varieties, agronomic and physical solutions… to keep pests/pathogens at acceptable levels

IPM of pest and diseases: successful tools

- **IPM in cereals with biofungicides**
- **IPM in strawberries with agronomic practices**
- **IPM in apple/grape with mating disruption**
- **IPM in protected crops with biocontrol agents**

IPM is feasible, many tools are available and more can be developed by investing in research and development



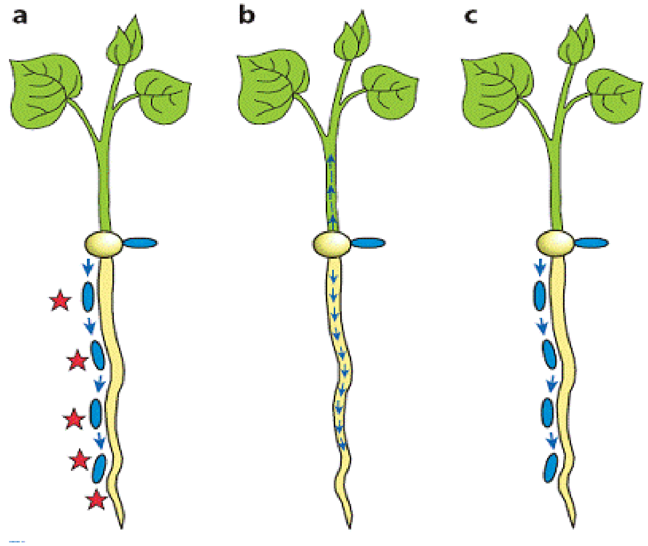
IPM of soil-borne diseases in cereals

Soil-borne fungal pathogens attack plant roots and cause important crop losses

The treatment of soil or planting material with certain strains of plant-beneficial, root-colonizing *Pseudomonas* spp. is a an effective alternative to control root diseases

The bacteria (*P. fluorescences, P. chlororaphis, Pseudomonas* spp.) colonize the seeds and plantlet and

- **directly control pathogens (secretion of biochemical compounds)**
- **stimulate growth and induce resistance on the plant**
- **compete for nutrients and space**

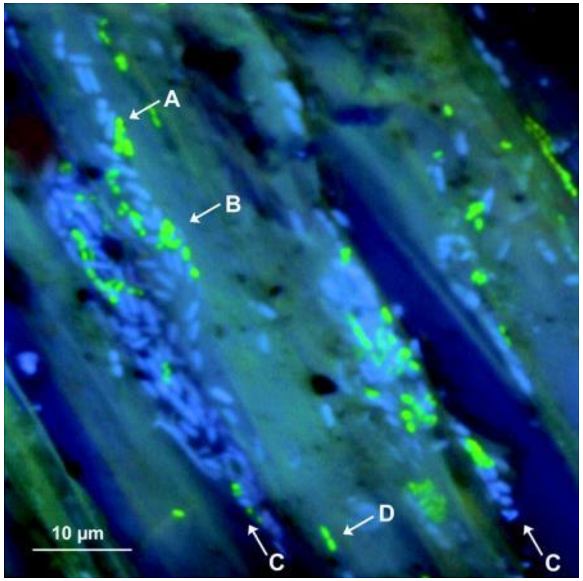


http://edoc.hu-berlin.de/

In Annex 1
Pseudomonas chlororaphis strain MA342
Pseudomonas sp. Strain DSMZ 13134

IPM in cereals: biofungicides

- *P. chlororaphis* MA 342 was developed as biological seed treatment products against *Ustilago spp., Bipolaris/Fusarium, Drechslera spp.*
- In Sweden: used on ~25 % of the 1,1 M ha cereal acreage
- Since the introduction during late 1990s, it has replaced over 1,5 million L of chemical fungicides in cereals (~100,000 L/year)
- No side effects, no development of resistance



Normander B et al..1999;

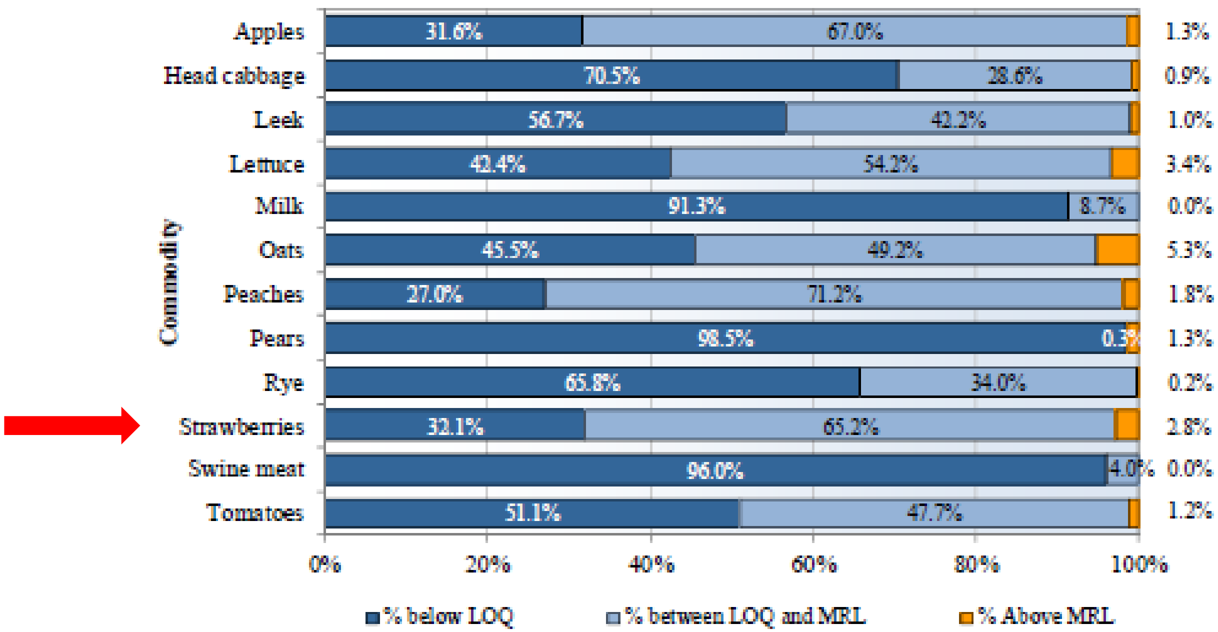
M Hökeberg, Swedish Univ. of Agric. Sciences

IPM and soil health

- **Several chemicals used in soil have been banned (methyl bromide and other fumigants)**
  - Soil replanting disease (toxins, allelopathy, pathogens, nutrients deprivation)
  - Soil-borne pathogens (Rhizoctonia, Armillaria, Rosellinia, Phytophthora, etc.)
  - Pests (nematodes, insects, etc.) and vectors of diseases
- **Crop rotation (monoculture=mechanization, specialization – crop diversification=market skills, area-wide organization)**
- **Resistant varieties (breeding , Marker Assisted Breeding)**
- **Cover crops (species and time)**
- **Compost (suppressiveness)**
- **Solarization (in northern climates in combination)**
- **Microbial biofungicides (minimum concentration, time to act)**

IPM of strawberry: high tunnels

- **Strawberries associated to high level of pesticide residues**
- **Grey mold and other fruit rots and mites**



Source: EFSA

http://strawberryplants.org

IPM of strawberry: high tunnels

- High light tunnels are relatively simple polyethylene-covered unheated structures placed over (drip) irrigated ground or suspended beds
- Plants covered just before bloom: prevention of rain reduce Botrytis and other fruit infections
- Green cover of soil (refuge for predators): prevention of mites
- Temporized overhead irrigation: prevention of powdery mildew (killed by water)

- From over 15 to 3-5 treatments per growing cycle

IPM of insect pests

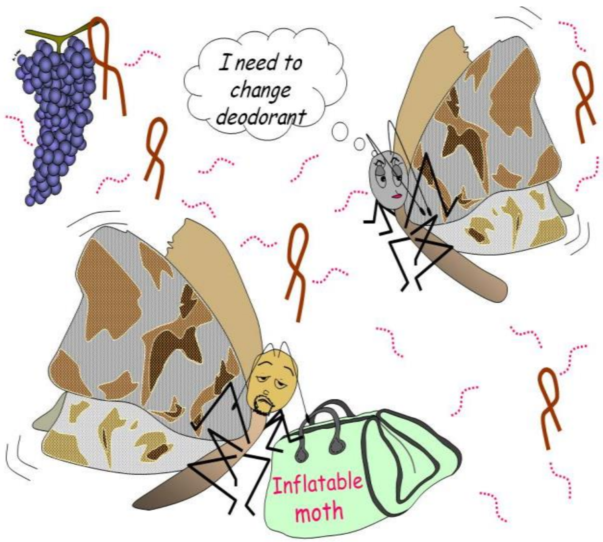
Lots of examples of IPM applied as “**Bio-intensive**”, relying firstly on biological control, agricultural control and plant resistance and, only when needed, on selective pesticides

IPM: a reality where well-trained consultants (eco-trainers, facilitators) and growers work in close connection with applied entomologists and plant pathologists

Recent progress of Research and Industry:

- new semiochemicals, new formulations, new ways of application
- efficient natural enemies of arthropod pests and more knowledge on habitat management to enhance natural enemies activity
- more selective and environmental friendly **pesticides** and **botanicals**
- availability of economic thresholds, monitoring systems, decision-making tools for many pests

Moths IPM: mating disruption (MD)



In Europe: MD applied on about **300,000** ha on GRAPE (150,000), POME (100,000), STONE (50,000)

In Trentino-South Tyrol: MD applied on 30,000 ha of apple and grape

APPLE

Piretroids banned, OP and ditiocarbammates strongly restricted

IPM guidelines supported by a «public-free of charge» advisory service

Monitoring and field scouting performed by consultants

Application of ET (Economic Thresholds) and EIL (Economic Injury Level)

Mating disruption against the Codling Moth (CM) and, if needed, sprayings against CM and non target pest with selective pesticides

IPM in Trentino South-Tyrol

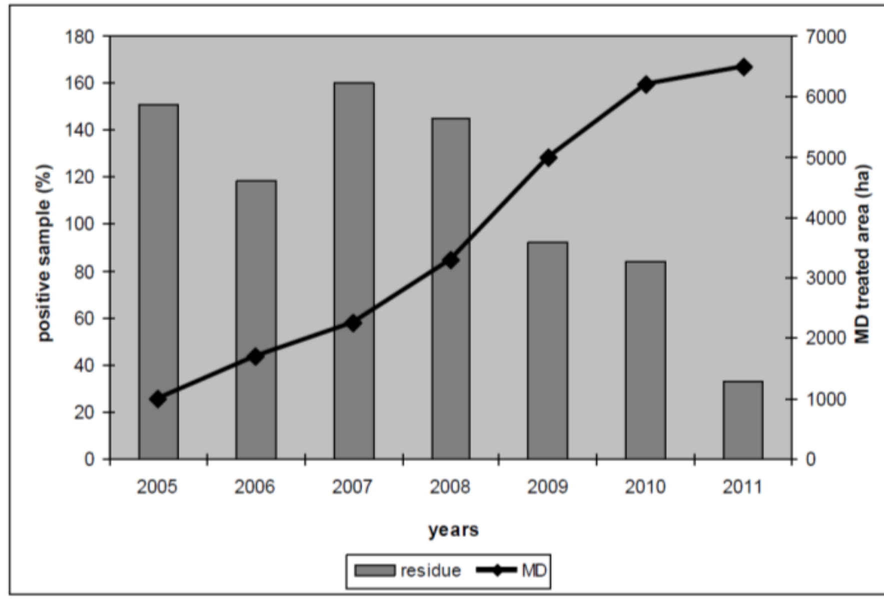


Figure 1. Percentage samples with insecticide/acaricide residues (gray bars) and area treated (ha) with mating disruption (black line) in Trentino.

Grape: 86% of grape samples free of insecticide and acaricide residues

Apple: strong reduction of pesticide residues in fruit samples and statistically significant reduction of the environmental impact

No reductions in crop yields or farm income

Insect pests IPM: protected crops

Efficient control of thrips, whiteflies, aphids, mites, agromizid flies, mealybugs, based on the release of predators and parasitoids. Selective pesticides when needed.

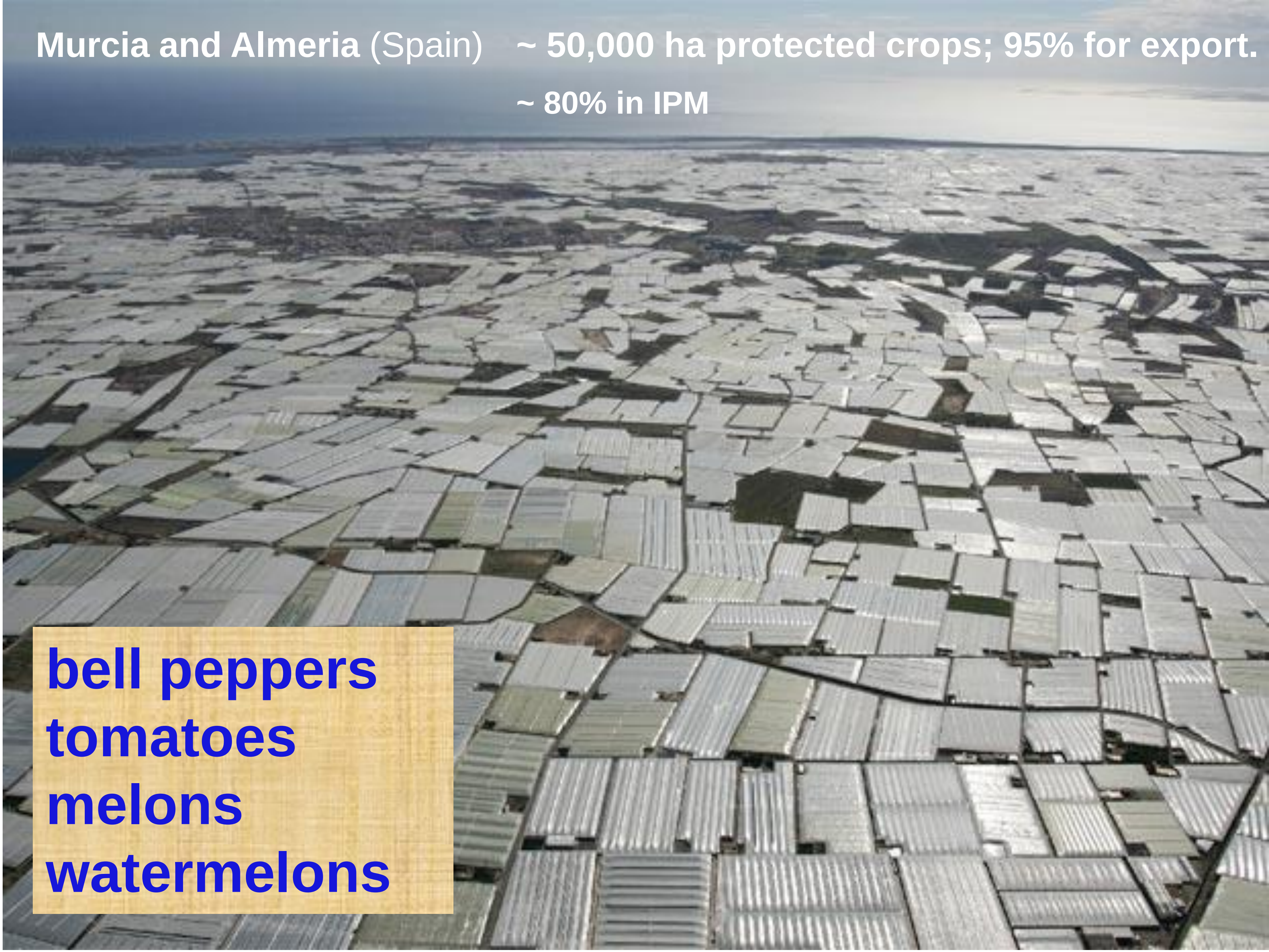
Nesidiocoris tenuis

Orius laevigatus

Amblyseius swirskii

Aphidius colemani

Encarsia formosa


Murcia and Almeria (Spain)
~ 50,000 ha protected crops; 95% for export.
~ 80% in IPM
bell peppers
tomatoes
melons
watermelons

Murcia and Almeria

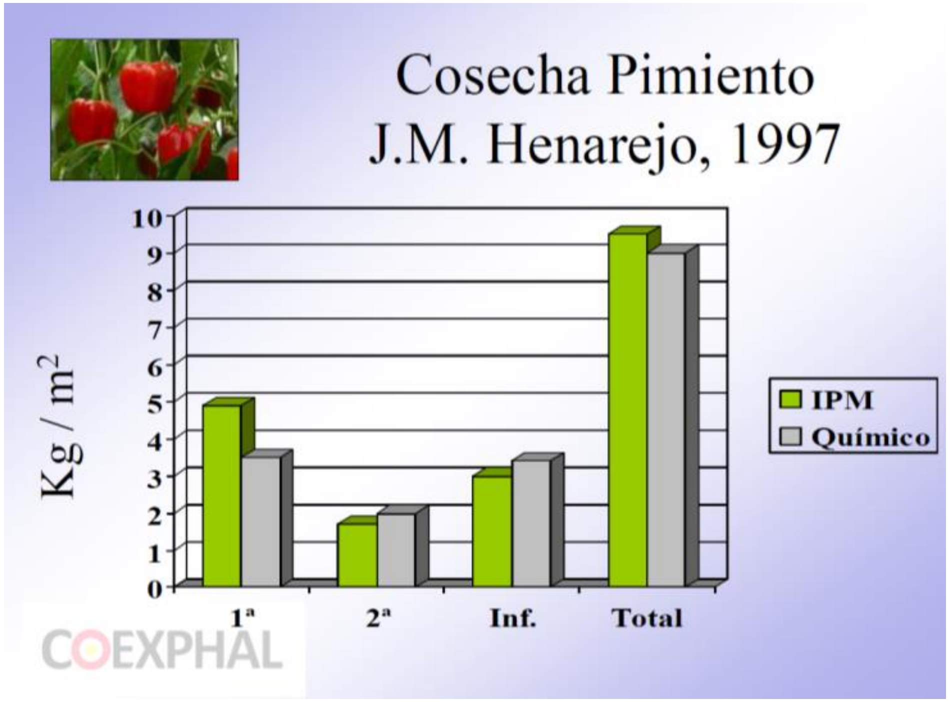
Until 10 years ago: ~ 30 sprayings/year with OPs or piretroids in green house of bell pepper crops (*Capsicum annuum*), with enormous problems of mites, pesticide resistance, TSWV and pesticide residues on vegetables

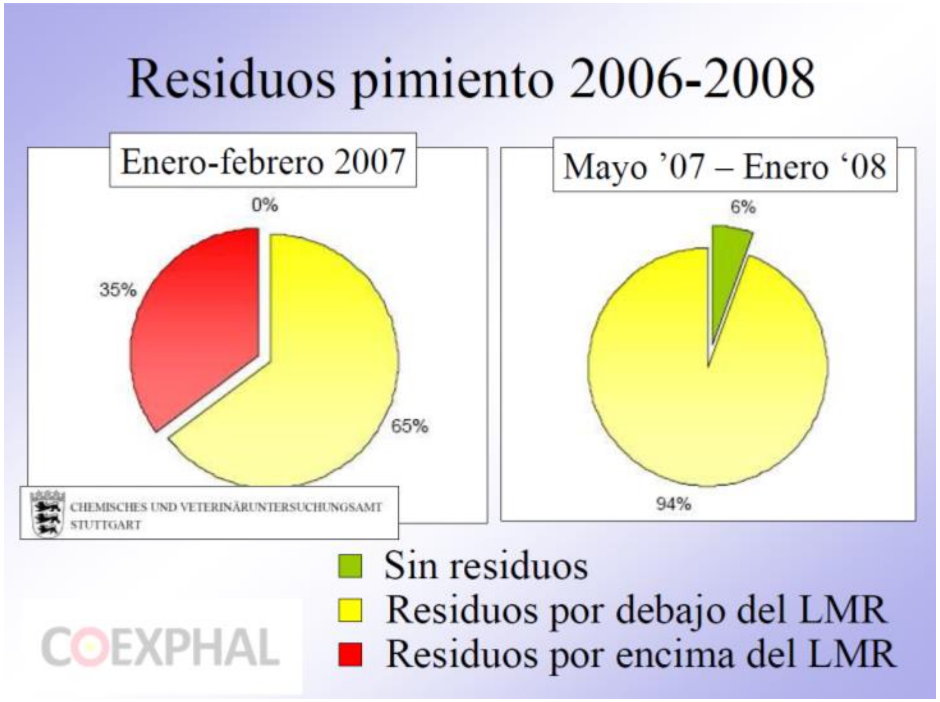
Today 100% of bell pepper in IPM

Release of BCAs (predators and parasitoids) against thrips, whiteflies and aphids
BT against phyllophagous Lepidoptera (*Spodoptera esigua* and *Heliotis armigera*)
MD against carpophagous Lepidoptera (*Ostrinia nubilalis*)

Selective pesticides when needed

Almeria (Spain)





A great amount of literature on IPM

Efficient ecological-based means and **strategies** are available as well as a great amount of **literature** on IPM

Many **textbooks** published to cover the basic components of IPM, its ecological foundation and the description of case histories on development and implementation of IPM for many crops

IOBC-WPRS IP & IPM: Crop specific Integrated Production Guidelines
http://www.iobc-wprs.org/ip_ipm/IP_guidelines_crop_sprecific.html

Pome Fruits
Stone Fruits
Arable Crops
Grapes
Soft Fruits
Olives
Citrus
Field Grown Vegetables

116 IOBC/wprs international **IPM Meetings**
116 Bulletins published in the last 10 years

IPM has proven to be a robust construct

How about the future?

An European Roadmap for IPM implementation

1. take advantage of the EU Directive 2009/128

2. Invest in research of new innovative IPM tools and knowledge

3. Promote, facilitate, encourage **in every possible way** the dissemination, the **information flow** and the **cooperation** between applied researchers, consultants, grower associations and/or motivated single growers

4. Train a generation of specialists to deal with the challenge of IPM and the complexity of crop systems

5. Promote application of IPM on an area-wide scale

The time has come for a major IPM adoption

Thanks for your attention

IOBC

www.iobc-wprs.org