Andermatt Biocontrol

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Insect pathogens as biological control agents by Andermatt Biocontrol

- Insect pathogens: an overview
- Baculovirus as biological control agent
- Case studies
- Questions / Discussion

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Insect pathogens: an overview

Entomopathogenic bacteria:

- ***Bacillus thuringiensis***
  - **Btk Kurstaki** Lepidopteran-specific toxins
  - Bta Aizawai Lepidopteran-specific toxins
  - **Bti Israelensis** Dipteran-specific toxins (Vector-control)
  - Btt Tenebrionis Coleopteran-specific toxin
- ***Saccharopolyspora spinosa*** **Spinosad**
- ***Lysinibacillus sphaericus*** Mosquito-control

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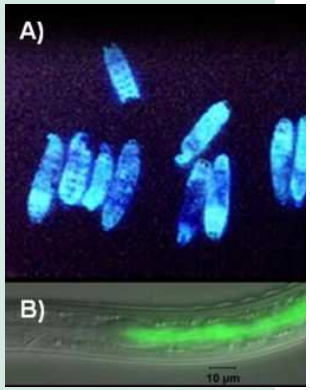
Insect pathogens: an overview

Entomopathogenic nematodes

- Symbiotic relationship: nematode – bacteria

- Broadly applied in horticulture and H&G
  - Lepidopteran larvae
  - Weevils, gnats, chafers



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Insect pathogens: an overview

Entomopathogenic fungi

- *Beauveria spp.*
- *Metarhizium spp.*
- *Lecanicillium spp.*
- *Isaria spp.*

- Widely used in protected crops
- Specificity depending species (co-evolutionary process)

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Insect pathogens: an overview

Entomopathogenic virus

- Baculovirus
  - Granulovirus (GV)
  - Nucleopolyhedrovirus (NPV)

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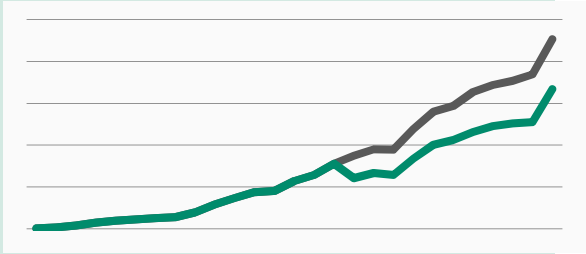
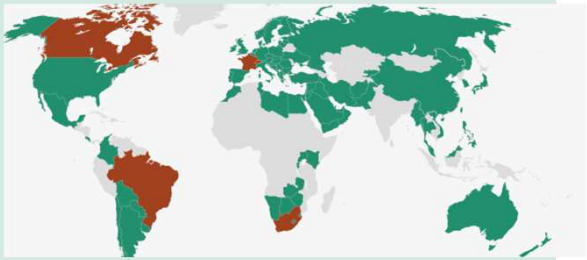
Andermatt Biocontrol at a glance

Providing good biological alternatives to replace chemical pesticides - for the production of safe food in a healthy environment!





- **30 years of experience in biocontrol**
- **Family- and employee owned**
- **World leader in baculovirus production**
- **Focus on quality & innovation**
- **~25 Mio. turn-over**
- **~100 employees**

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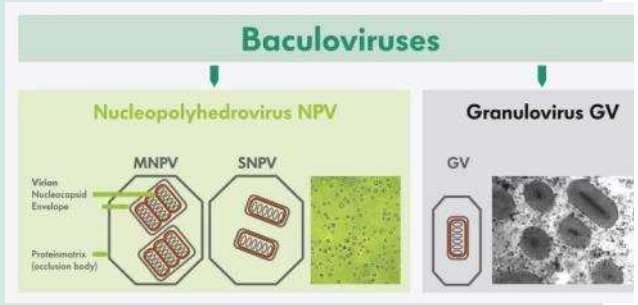
What is a baculovirus?

- **Naturally occurring pathogen in insect populations**
  → GMO free
- **Only found in insects (mainly lepidopteran species)**
- **Very host specific virus**
  - no adverse effects on beneficial insects, on plants, mammals or aquatic organisms
- **Safe for user and consumer (OECD Consensus Paper 2002)**



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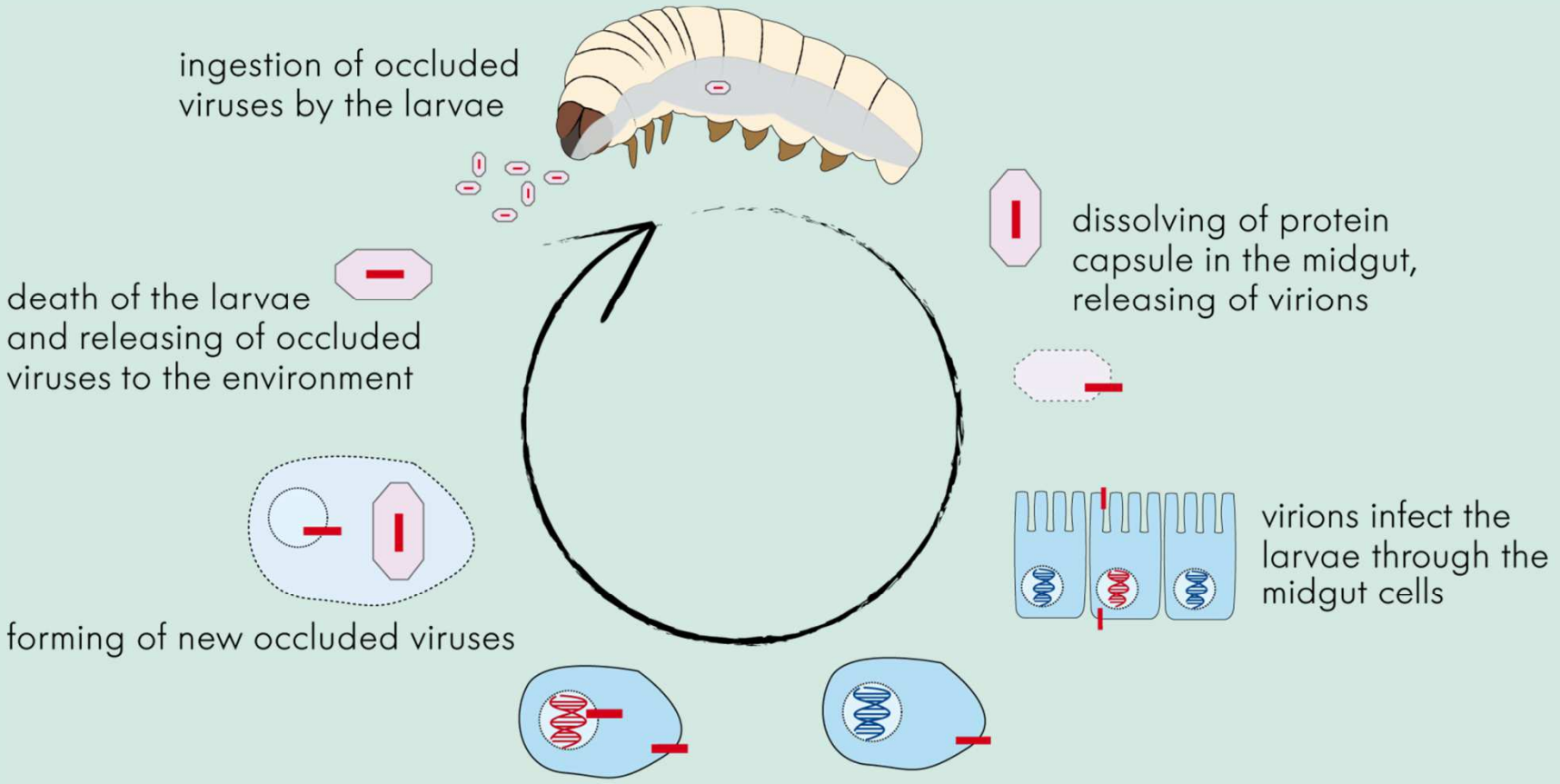
Mode of Action of a baculovirus



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Infection of the larvae

- **At egg hatching**
- **During migration phase on the plant**
- **At penetration into the fruits**

The larvae has to ingest the virus. A cutaneous infection is not possible.

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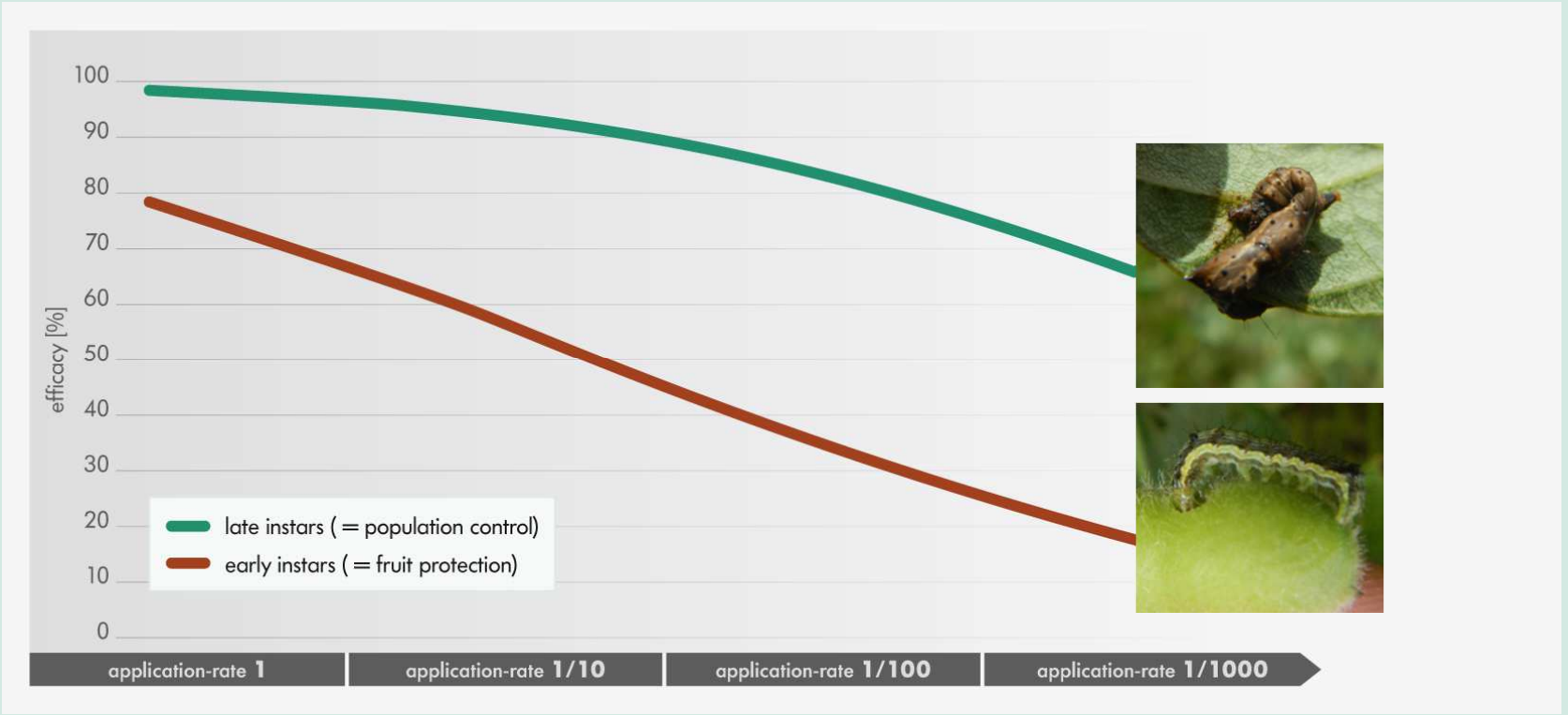
Dose-Response relationship



Huber, BBA Darmstadt

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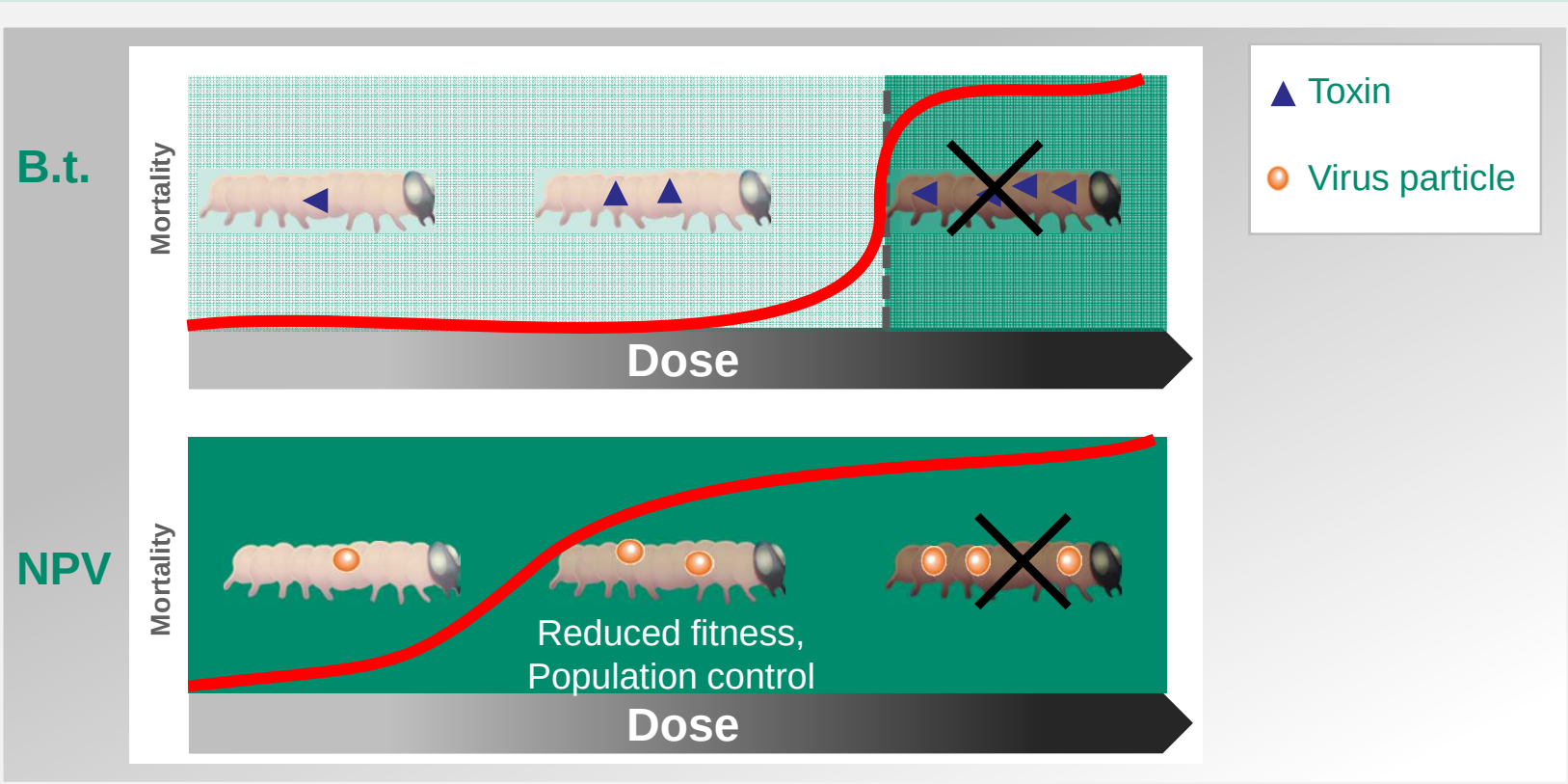
Mode of action of Bt-Toxin and NPV



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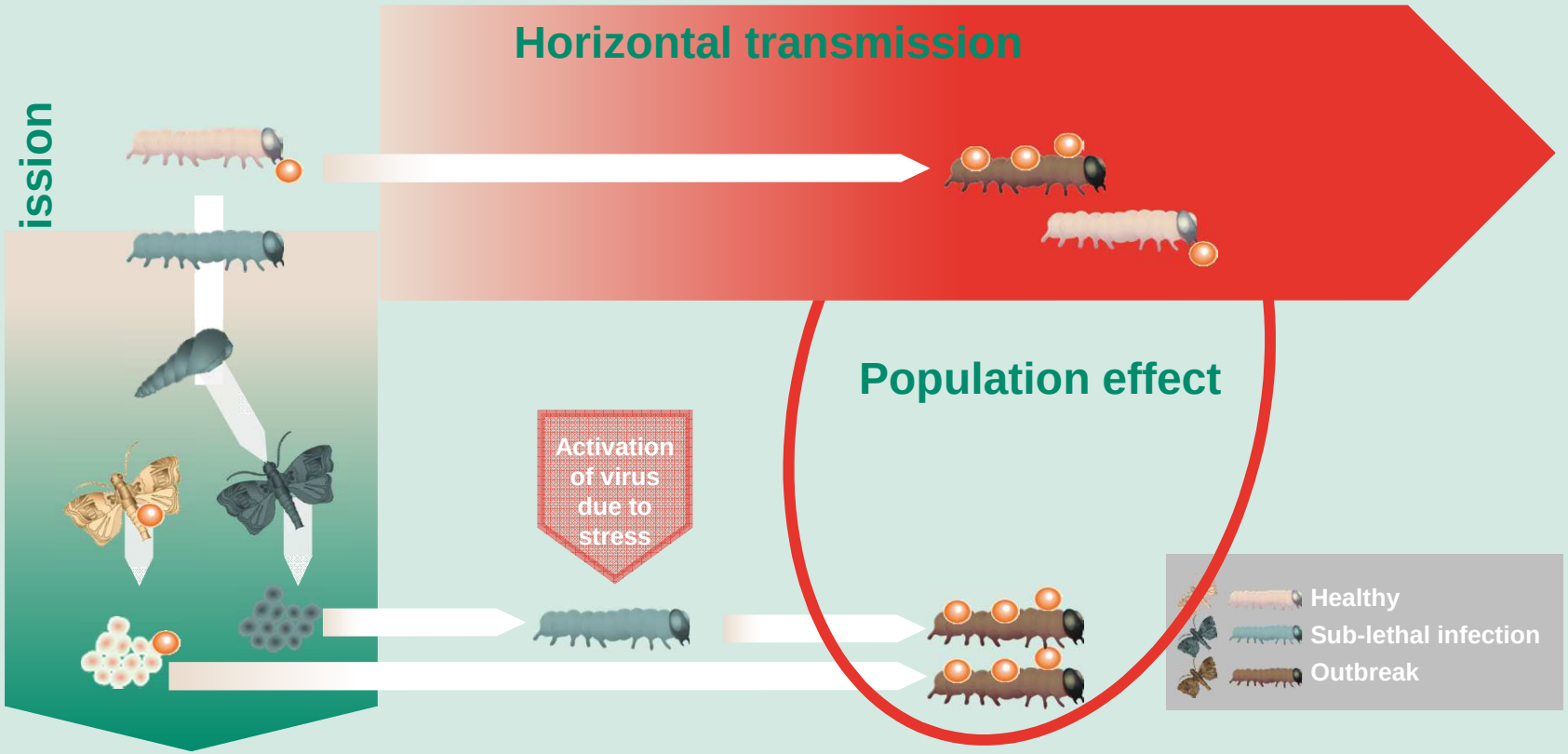
Transmission of baculoviruses



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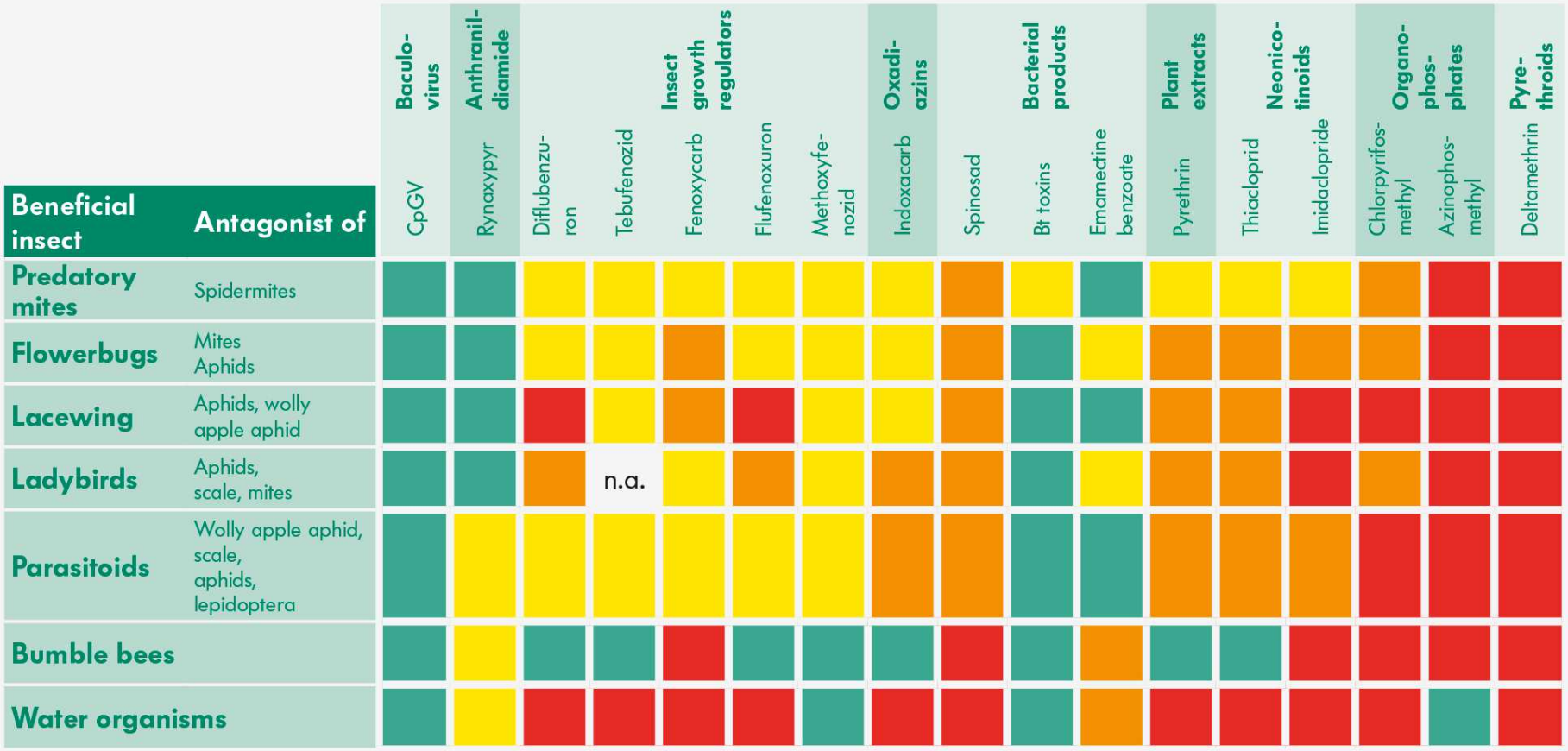
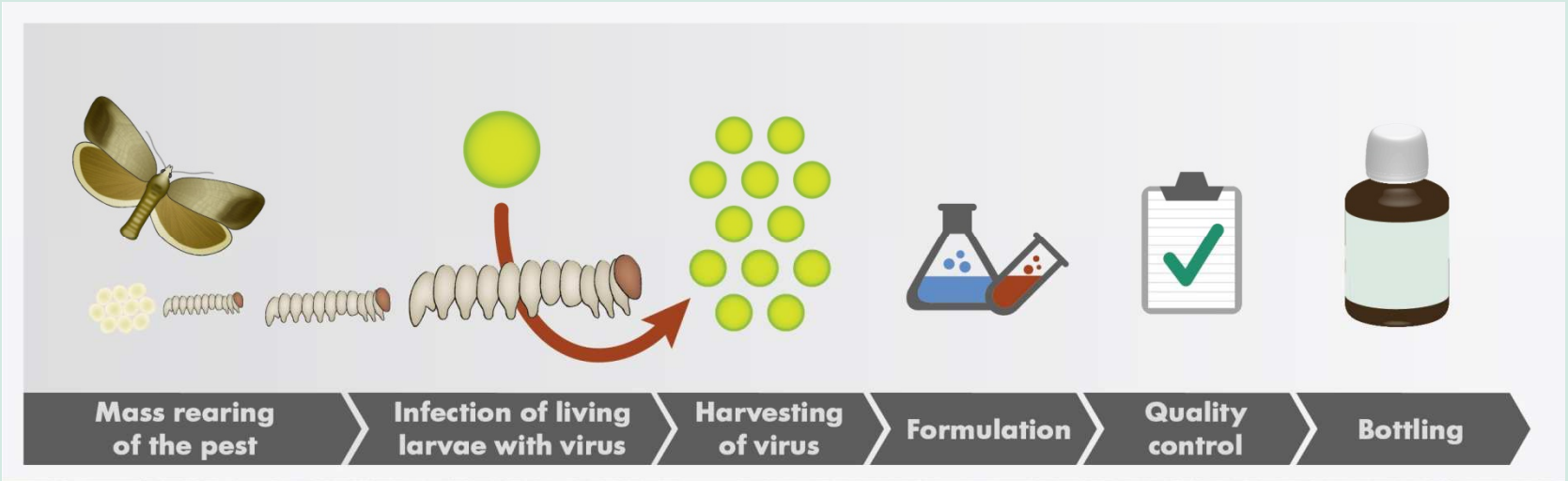
Toxicity of different active substances on beneficial organisms in fruit production



Virus production in vivo



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General application strategy for virus products

Application timing

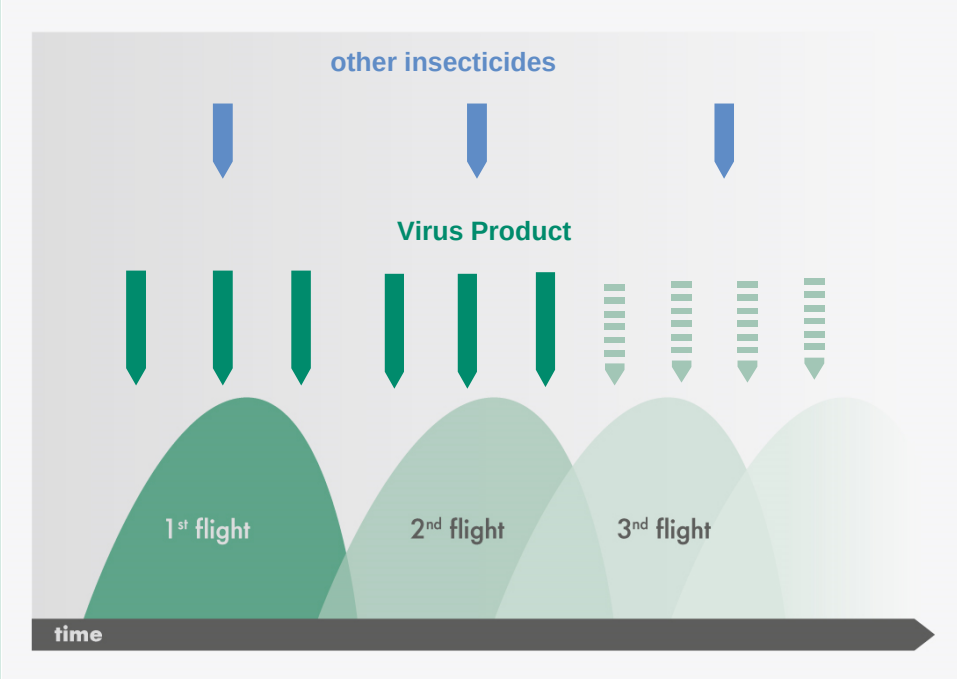
- targeted on eggs and against first instar larvae

Application rate

- Full rate every 8 days
- Half dosage every 6 days

Remarks

- cover the whole larval hatching period of the treated generation until harvest



Most relevant are right application timing and good coverage.

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Summary
Baculoviruses in IPM

- Naturally occurring viruses for inundative biological control of key pests
- Highly specific and efficient tool for IPM
- Challenges: UV-sensitivity, slow speed of kill, high production costs
- Population control: positioning at the beginning of the pest life cycle
- Highly compatible with other inputs and beneficials
- Residue free, safe for producers and consumers

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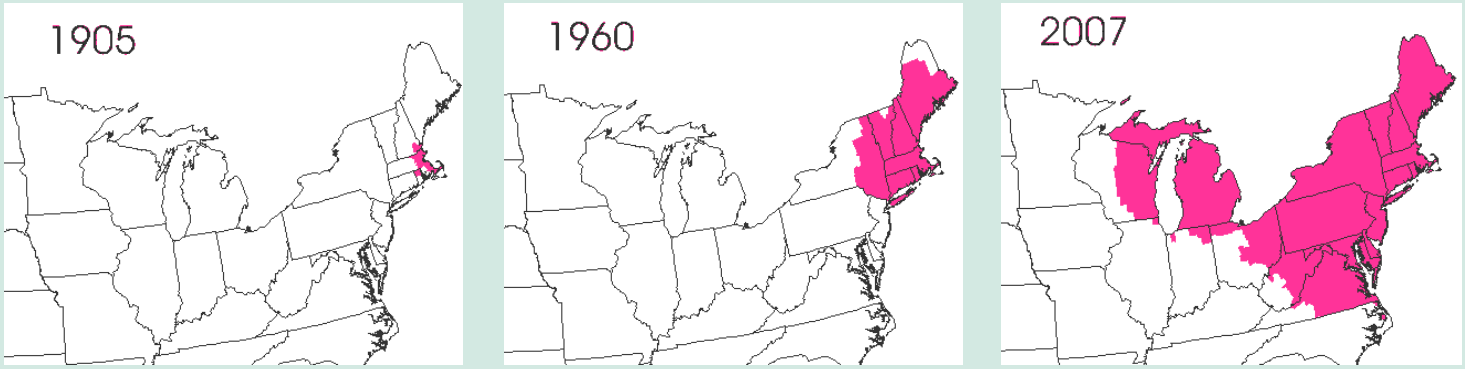
Case study I : Invasion of Noth America by *Lymantria dispar* - European Gypsy moth

- **Natural occurence:** Europe, Mediterrean basin, Middle East, Asia
- **Important forest pest**, invading large areas in years of gradation, increasing tree mortality
- Health issue (allergenic reaction)
- **First recorded in the US: 1869**

Source: www7.inra.fr



Source: www.fs.fed.us

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Gypsy moth control in the USA

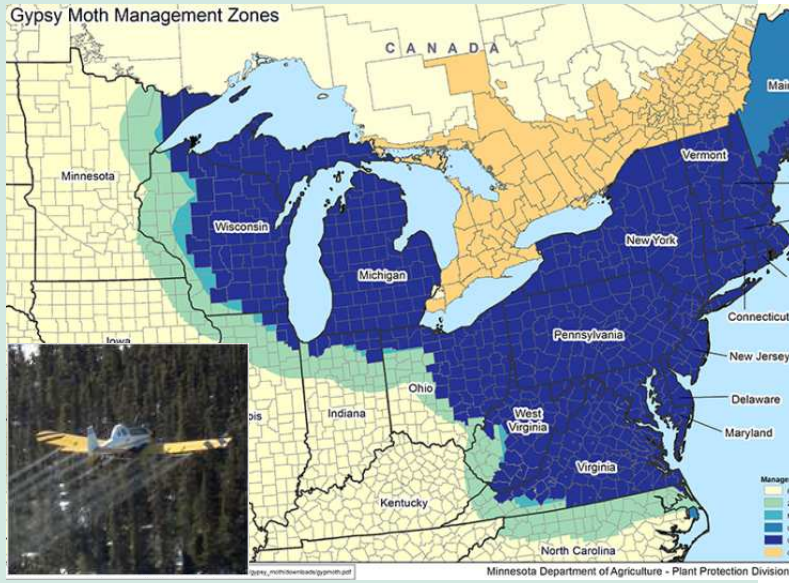
- **Quarantine area (dark blue):** Monitoring and control

  => Suppression

- **Barrier zone (grey-green):** designed to delay spread and permanent establishment

  => Eradication

  - Btk as first choice of control (Cost effectiveness)
  - **GypCheck (LdMNPV)** for environmentally sensitive areas



Source: www.mda.state.mn.us

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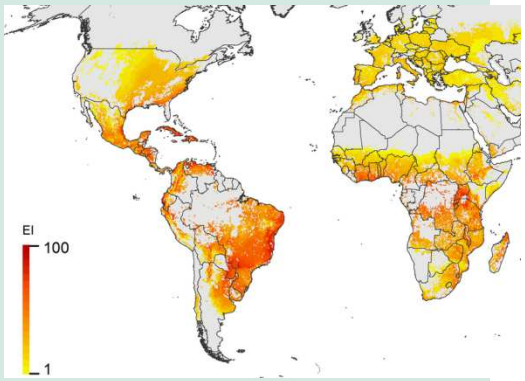
Case study II : Invasion of South America by *Helicoverpa armigera*- African cotton bollworm

- **Natural occurence:** Africa, Middle East, South East Asia
- HELIAR: very polyphagous, high fecundity, highly migratory, facultativ diapause

  => High damage potential
- **First recorded in Brasil: ~2010**
  - Resistant to many commonly used insecticides
  - Invading monocultivations of soy (~60Mio. ha), corn and cotton



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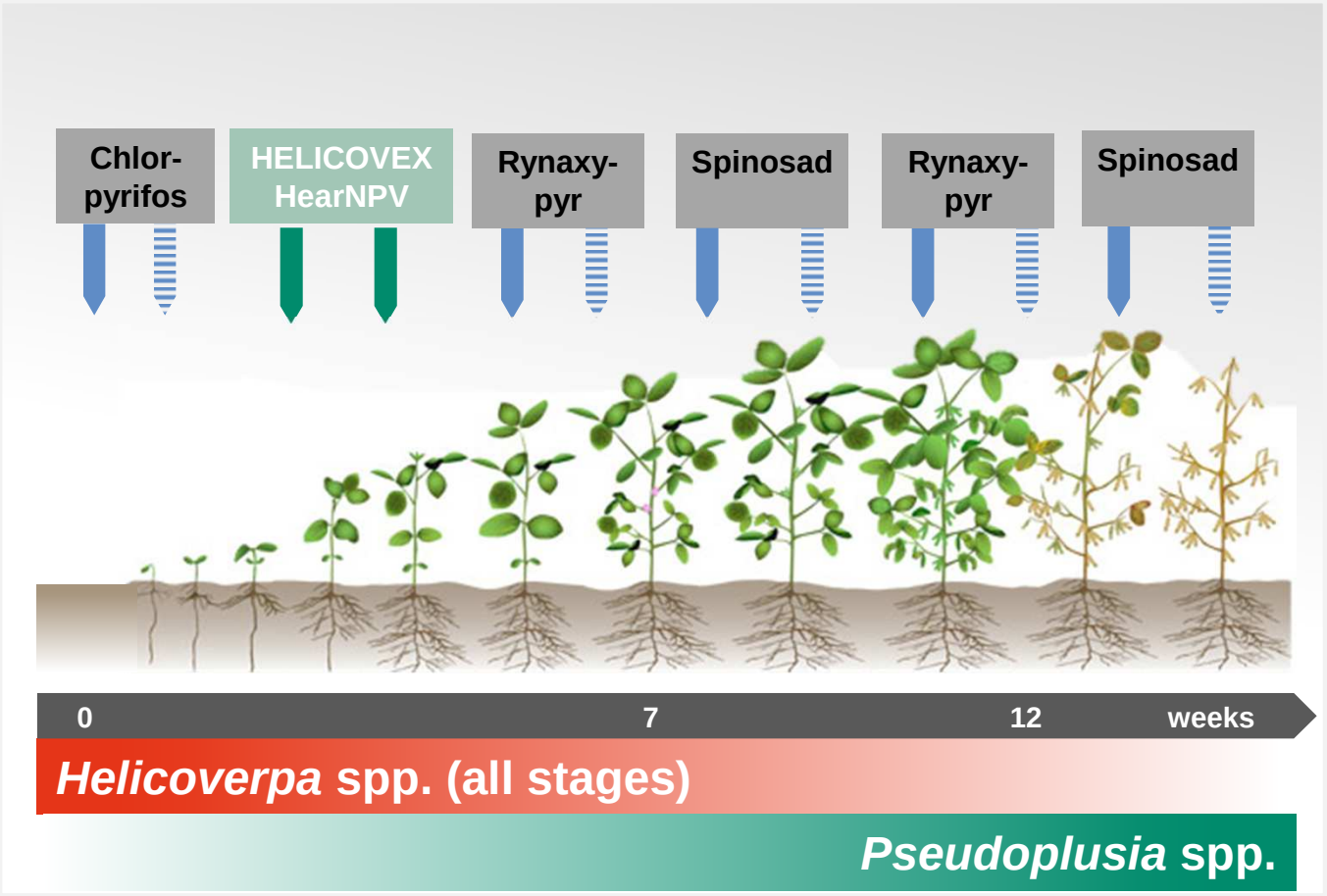
Helicovex on soybean (BRA)
Example of an IPM program



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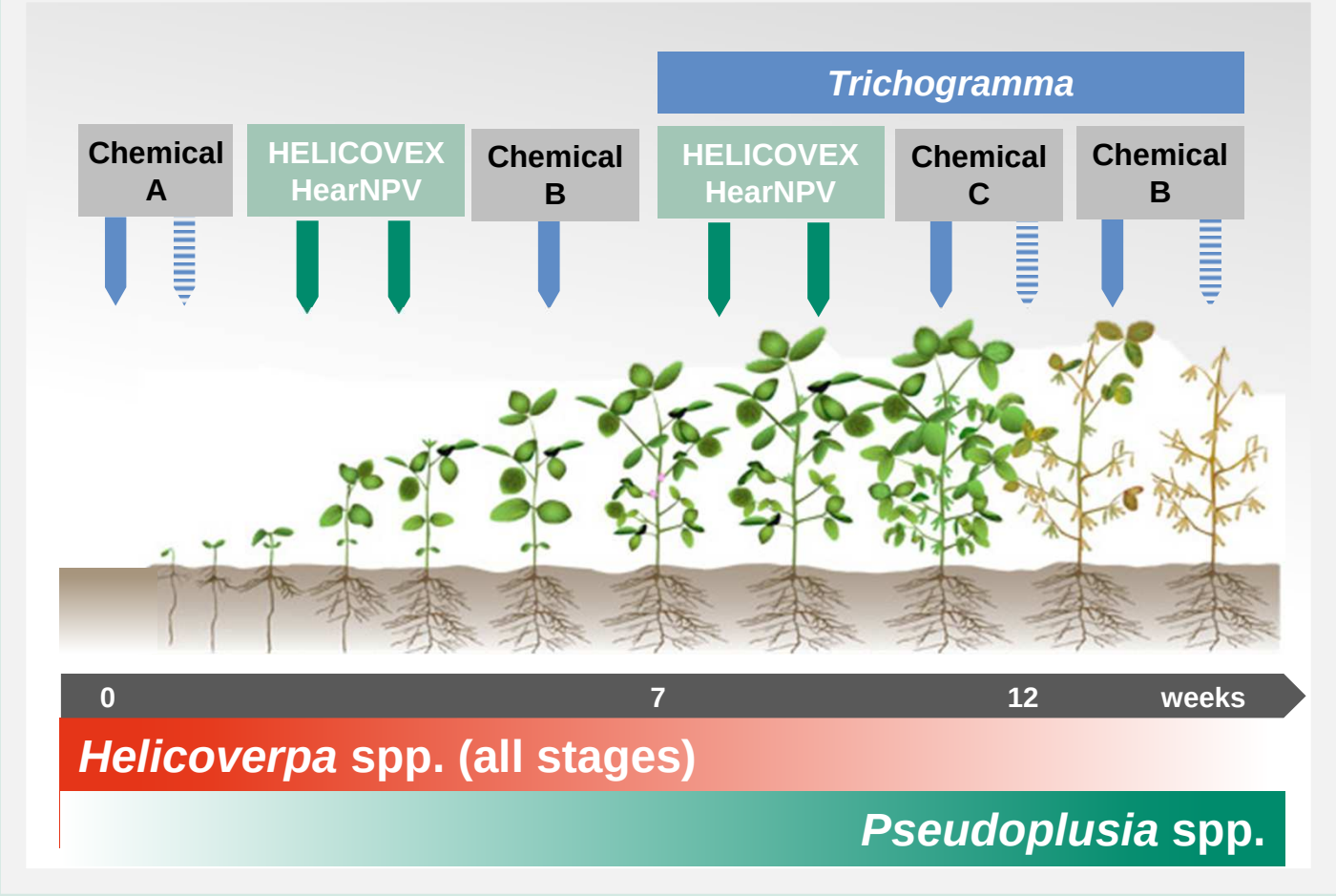

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Case study III : Invasion of Israel by *Thaumatotibia leucotreta* – False Codling moth

- **Natural occurence:** Subsaharan Africa
- **FCM: very polyphagous**
  - Main host plants: Citrus, Table grapes, Avocados, Pomegranates, Capsicum

  ⇒ High damage potential

- **Quarantine pest in export destinations**
- **First recorded in Israel: 1986**
  - Initially on Macadamia
  - Currently main pest on Pomegranate and Citrus

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FCM control with CRYPTEX on citrus

- Apply at least 3 application of Cryptex per season
- Always focus on the first FCM generation to push down the population
- Final application 3-4 weeks before harvest can reduce the population at harvest period
- For optimal FCM control use Cryptex as standard element in a plant protection programme
- Can be combined with mating disruption
- Tank mixes with other pesticdes

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Baculoviruses – Challenges and Chances

Virus biology

- Narrow host range
- Slow speed of kill
- Persistence / UV sensitivity

Production (in vivo)

- Labor intensive
- Consistent product quality

- ► Target key pests
- ► High value crops
- ► Export markets (residues)
- ► Resistance problems with conventional insecticides

- Reliable instructions
- Logistics and storage

Distributor

- Proper timing
- Logistics and storage

End user (farmer)

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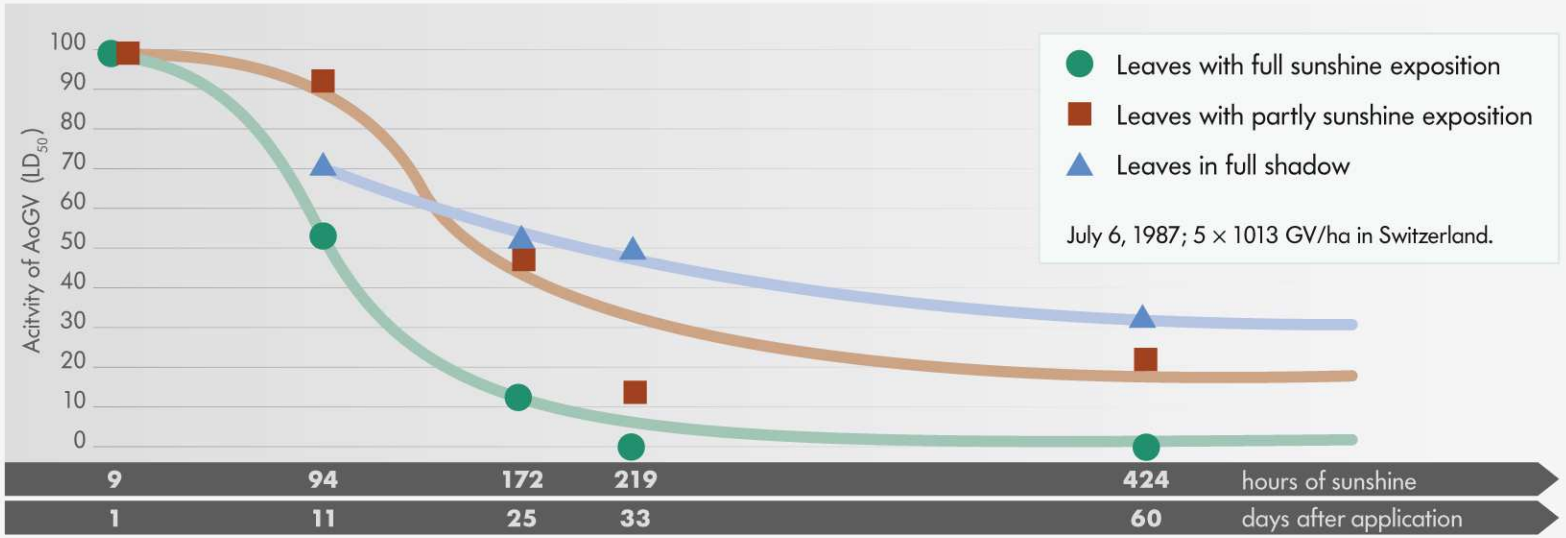
where Nature leads Innovation

Mortality of first instar larvae of *Adoxophyes orana*, fed with AoGV treated leaves

Decrease of the activity of AoGV depending on the exposition of the leaves after a summer application



Andermatt, 1988

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