Baculovirus FAQ's




Andermatt
Madumbi

INTRODUCTION:

Andermatt Madumbi is a member of the Andermatt Group, global leaders in baculovirus production with more than 35 years of experience in their development, formulation and production.

The term 'baculovirus' includes both granuloviruses and NPV (nucleopolyhedro virus) formulations. Baculovirus solutions are a unique category (IRAC code 31) within bioinsecticides. Bioinsecticides, offering highly specific pest control, targeting one or very few closely-related insect species. Baculoviruses are naturally occurring pathogens of certain insects, mainly lepidopteran species. They need to be ingested by the larvae to start the infection cycle.

Key benefits of baculovirus solutions:

- Efficient population and damage control
- Excellent resistance management tool
- High compatibility with other products
- Non-toxic for beneficials, no MRL, withholding period and re-entry interval restrictions
- Good rainfastness

DID YOU KNOW?

1. Baculovirus general information:

Production and Quality Control:

- The production of baculovirus solutions is a highly specialised process.
- The Andermatt Group continuously invests in inhouse R&D ensuring constant improvements and new developments.
- Routine quality control bioassays are conducted to ensure consistent product performance.
- Andermatt Biocontrol Suisse is the manufacturing subsidiary within the Andermatt Group, dedicated to the development, formulation and application strategies of baculovirus products.

Andermatt
Biocontrol Suisse

- Stability of production process
- Strict quality control

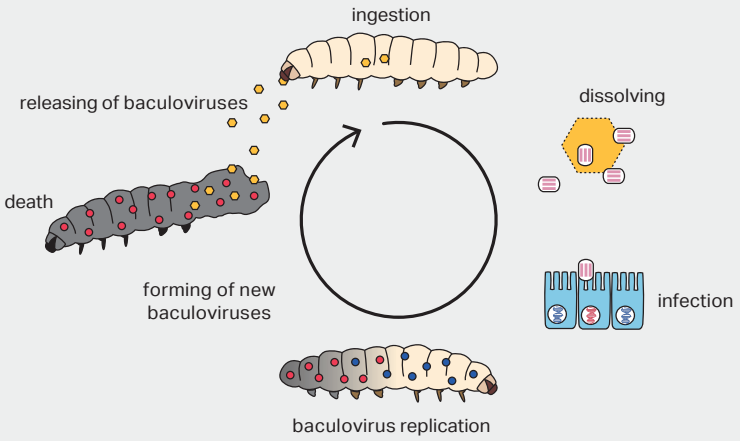
- In-house research and development
- Large and growing portfolio across various crops
- Experience in various crops
- Longstanding field support in different markets

- Unique formulation properties
- Selected isolates
- Highly concentrated product

2. Mode of action of baculoviruses:

This image portrays a simplified version of the mode of action of baculoviruses:

- Virus particles (occlusion body = OB) must be ***ingested*** by the larvae.
- The protein capsule of the occlusion bodies is ***dissolved*** by the high pH of the larvae's midgut.
- The infective part of the virus is released ***(occlusion derived virus, ODV)***, enabling the primary infection of the midgut cells.
- ***Replication*** takes place in the nuclei of the midgut cells, followed by ***cell-to-cell*** infection of the entire larva.
- Towards the end of the infection cycle, larval host cells produce and ***release the occlusion bodies***, which are ***infectious for other larvae of the same species.***
- Protected by the occlusion body the virus is able to remain viable outside of the host when not exposed to high levels of UV, ready to infect the next larvae.



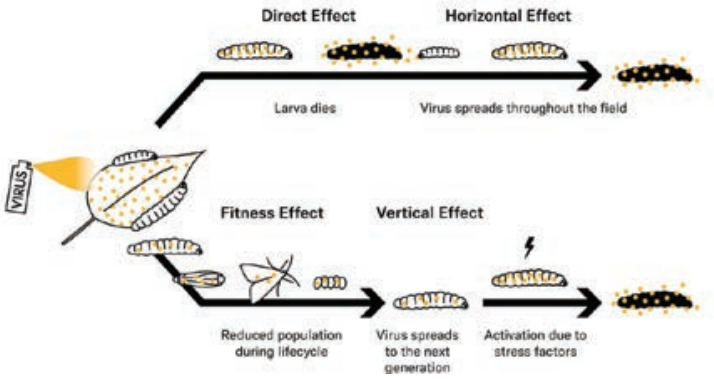
3. The effects of baculoviruses, explained:

At Andermatt 4 effects of baculoviruses are defined:

- ***Direct effect*** on larvae present in the field. The larvae die after ingestion of treated plant material.
- ***Horizontal transmission:*** After larva death, the larva ruptures, occlusion bodies are released in the field and may cause new infections.
- ***Vertical transmission affects the next generation*** (can occur when baculovirus infection occurs late in the life cycle of the target pest, with late instars ingesting few baculovirus particles leading to a sublethal dose rate):
  - Baculovirus is transmitted to the next generation.
  - Next generation larvae may carry a viral infection which only causes an outbreak after activation through stress factors.
- ***Fitness effect***
  - Sublethal virus infection: The population growth is reduced, e.g. pupation rate and pupae hatching rate is decreased with baculovirus infection.
  - Potential stress factors are e.g. heat, other ppm, etc.

  Population effect is a combination of the horizontal effect, vertical effect and fitness effect.

Population effect – vertical transmission



Data from a lab trial with Helicovex on *Helicoverpa armigera*

4. Baculovirus effects summarised:

	Baculovirus	Conventional insecticide
Mortality of pest present at application	✓	✓
Infection of other larvae within field	✓	✗
Reduced fitness	✓	✗
Stress causes virus outbreak	✓	✗

This graphic summarises the key baculovirus effects

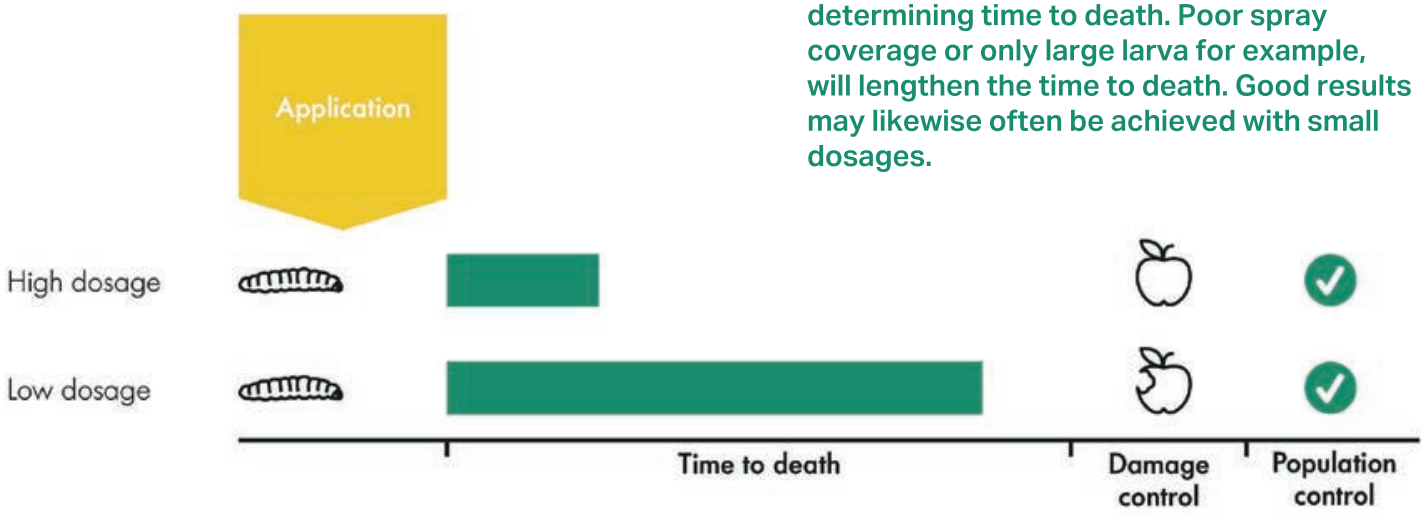
5. Different dosages determine the time to mortality

Baculoviruses do not have a typical dose response, with different dosages (number of virus particles ingested) affecting time to death.

- ***High dosage:*** larva dies quickly, thus the larva causes little crop damage. The larva takes up a higher baculovirus load, so it reaches a sufficient load which leads to quicker mortality.
- ***Low dosage:*** larva dies slowly and therefore the larva causes more crop damage.
- This is only valid until the maximum dosage is reached, whereafter increasing dosage further will not make a significant difference.

Key take out:

Dosage is only one factor potentially determining time to death. Poor spray coverage or only large larva for example, will lengthen the time to death. Good results may likewise often be achieved with small dosages.

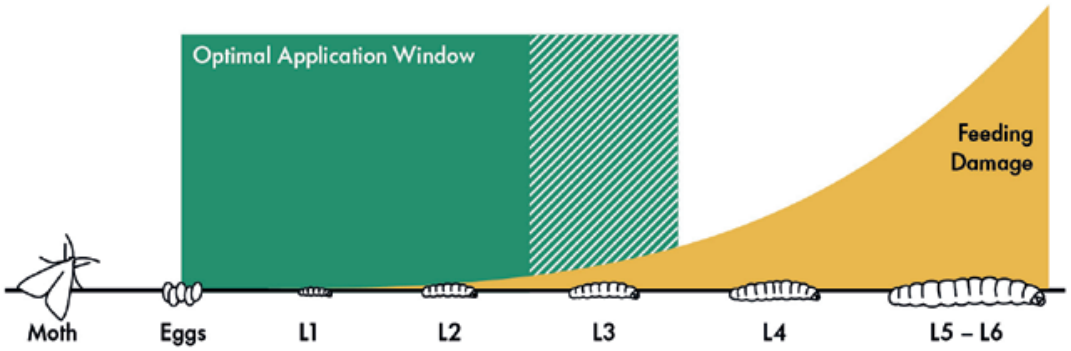


6. Application timing is important and is one of the factors that determines efficacy:

- Target eggs and first instar larvae.
- Some species feed on eggshell during hatching, as such the application on eggs can be useful in these cases.
- Mortality of young larvae is quicker and results in less crop damage (L1/L2 larvae die faster than L3 - L6 larvae).
- Usually, bigger larvae incur quicker feeding damage on leaves and fruits.

Key take out:

Ideally start to apply product with hatching of eggs and cover the whole larval hatching period.



Application rates and intervals:

HIGHER RATE

- High pest pressure
- Harvestable structures present
- Stand-alone application
- High value crop
- During reproductive growth stages (e.g. flower buds, flowers or harvestable structures already present)

LOWER RATE

- Low pest pressure
- Vegetative growth
- In tank mix with product targeting the same pest (Integrated Pest Management (IPM))
- In strategies where applications are done with shorter intervals

	Application rate	Application interval
High crop	↑	
Fast plant growth		↓
Harvesting structures present	↑	↓
High pest pressure	↑	↓
Fast pest pressure increase	↑	↓
High UV		↓
Tank mix with product targeting same pest	↓	
Rotation with product targeting same pest		↑

↑ Higher application rate/longer interval

↓ Lower application rate/shorter interval

7. Good spray coverage is essential:

There is no systemic or translaminar effect of baculovirus products. Application techniques are a key part of product efficacy in the field.

When considering which area of the plant should be sprayed for best efficacy, ask yourself these questions:

- Where does the pest occur on the plant?
- Where are the eggs laid?
- Where do the small larvae feed?

Good coverage

Bad coverage

Key take out:

The product needs to be ingested by the larvae to have an effect.

8. Andermatt's baculovirus products are ready to use:

- UV protection is included in the formulation.
- No feeding stimulants, surfactant/wetting agents or other adjuvants are needed.
- Non-ionic or oil-based spreaders or stickers may be used on crops with waxy surfaces (e.g. brassica).

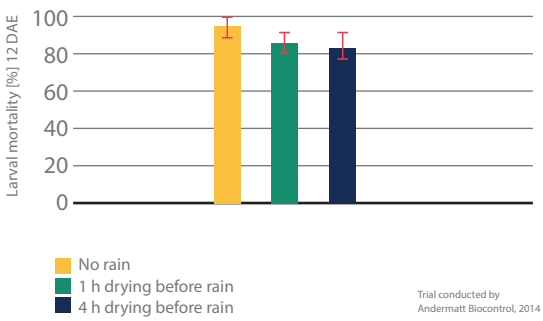
Key take out: Check good spray coverage with water sensitive paper.

9. Temperature vs UV radiation:

- Temperature effects the development rate of the pest.
- UV radiation affects the viability of the baculovirus particles more quickly than high temperatures in the field.
- Full application rate ensures coverage for 8 sunny days.
- Product can be applied during the whole day, but spraying in the afternoon or evening is recommended.

10. Rain fastness:

Good rain fastness of Bolldex®on soybeans is demonstrated in the graph below:



No significant wash-off in the lab after strong simulated rain (30 mm, 1 h) on soybean leaves.

- Treatment of soybean plants with Bolldex® 0.03% (dripping wet, applied with manual pump sprayer, equivalent to 200 ml Bolldex® in 600 L water).
- Intervals between Bolldex® application and rain: 1 h and 4 h, respectively.
- Simulated rain: 30 mm, 1 h.
- Exposure of *H. armigera* larvae to treated leaf rondelles for 24 hrs.
- Transfer to bioassay units and assessment of mortality 6 and 12 DAE (days after exposure). Mortality 12 DAE is presented in the graph.

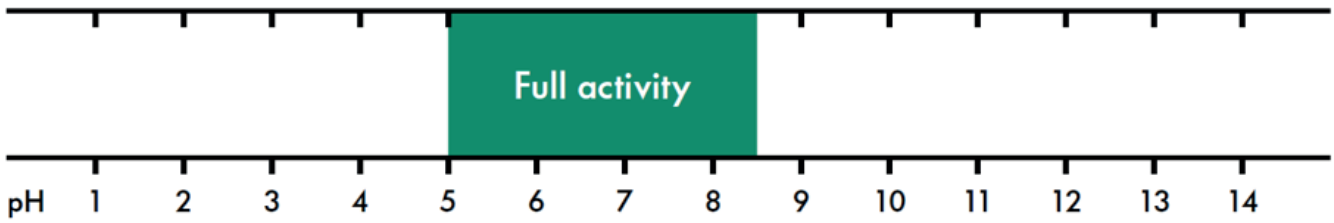
11. Compatibility in tank mix:

Andermatt's baculoviruses are compatible with most insecticides, fungicides and fertilisers as long as a pH level between 5 and 8.5 in the tank mix is respected.

Restricted compatibility may occur for some copper-based products, as well as acidic (pH < 5) and alkaline (pH > 8.5) products. Please consult the compatibility list before tank mixing with such a product.

Always add the baculovirus product last to the tank and never mix with another concentrated agricultural product. Apply tank mix as soon as possible after mixing.

Many relevant products have been tested for compatibility with baculoviruses in laboratory bioassays. These documents are available on request.



Cryptex® compatibility in the tank mix is extended to pH 4 - 9

12. Baculoviruses are safe

- Baculoviruses are ubiquitously and naturally present in the environment and have been applied to control insect pests in agriculture for over 100 years. E.g. Codling moth has been infected by Codling moth granulovirus for thousands of years.
- The baculoviruses in our products naturally occur and are not genetically modified.
- Baculoviruses are highly host specific.
- Baculoviruses are safe for other insects like bees and beneficial insects.
- Baculoviruses have evolved over millions of years within their insect hosts and are not related to human pathogenic viruses.

13. Commonly asked questions from the field

Is there a significant difference, both practically and technically between an NPV (Nucleopolyhedrovirus) and GV (Granulovirus) formulation?

There is no practical consequence of a product being an NPV or a GV. As such, the positioning of the baculovirus solution in the individual IPM strategy should be based on the targeted pest species rather than the type of virus.

Is there a difference in potency between NPV and GVs?

The potency is as determined by the specific virus isolate. This will impact uniquely on the targeted insect and will be influenced by the insects behaviour to the host plant. Rather than questioning the potency, growers should rather question the virus isolate being used, in combination with the virulence as well as the viability of the virus particles in a product.

Why is there such a significant difference in the concentration of the Andermatt baculovirus products?

With baculovirus solutions, potency results from the host-virus interaction. This results in a different number of OB (occlusion bodies) being required for each different product (and target), this is determined using LC 50 values. As manufacturers we have formulated each product accordingly to ensure good efficatcy in the field, this is confirmed during the Quality Assurance process via bioassays.

Definitions:

- **Occlusion body:** occlusion bodies are composed of the matrix that occludes the virions and an outer membrane-like structure on the surface. The occlusion body itself is formed by the protein polyhedrin / granulin. Inside the occlusion bodies, the virus is able to survive outside of the host for a long time in protected environments.
- **Virion:** Virus particles, called virions, contain the viral genome inside in a protein coat. The virion is an entire virus particle, the infective form of the virus

Andermatt Madumbi baculovirus solutions

Cryptex®

For the biological reduction of False codling moth larvae (FCM) *Cryptophlebia / Thaumatotibia leucotreta* on crops as listed.

Bollex®

For the biological reduction of African bollworm (ABW) *Helicoverpa armigera* larvae on all crops.

Madex®

For the biological reduction of Codling moth larvae (CM) *Cydia pomonella* on apples and pears.

For more information contact your **Andermatt Madumbi** biospecialist or visit **www.andermatt.co.za**

Andermatt Madumbi

Healthy Food and Healthy Environment, for all

Andermatt Madumbi (Pty) Ltd
T: +27 (0) 33 342 3984
E: support@andermatt.co.za
W: www.andermatt.co.za

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Bolldex® contains *Helicoverpa armigera* Nucleopolyhedrovirus (HearNPV). Reg. No. L8895, Act No. 36 of 1947. Cryptex® contains *Cryptophlebia / Thaumatotibia leucotreta* Granulovirus (CrleGV). Reg. No. L8037, Act No. 36 of 1947. Madex® contains *Cydia pomonella* Granulovirus (CpGV). Reg. No. L7950, Act No. 36 of 1947.

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