



Baculovirus FAQ's

The Andermatt Group is the global leader in baculovirus production with more than 35 years of experience in their development, formulation and production.

The Andermatt Group is home of two leading baculovirus manufacturing companies. Andermatt Biocontrol Suisse and Andermatt Canada. Together, they offer the widest range of commercially available baculovirus products for agriculture and forestry use.

Through the power of the collective expertise within the Andermatt Group, Andermatt brings growers the best the world has to offer in innovative and sustainable biological solutions.



Why use baculovirus products by Andermatt?

There are many benefits of using baculovirus products for pest control:

Unique mode of action

- Pest population reduction over time
- Excellent resistance management tool

No residues and non-toxic

- Complies with IPM and organic production
- Maintain benefits of beneficial insects and pollinators in your field
- Safe for producer, consumer and the environment

Unique formulation

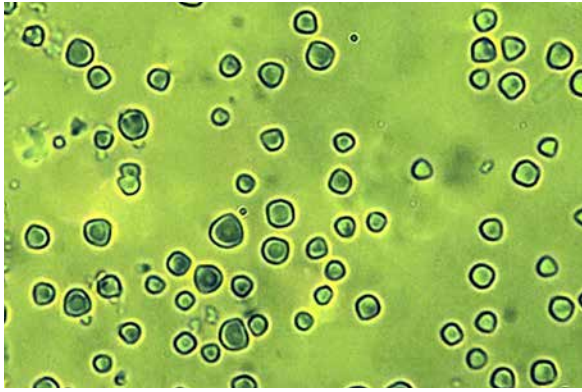
- High compatibility in tankmix with other products
- Good storage stability when cooled
- Good rainfastness

Science based

- Reliable high-quality product with proven efficacy in the field
- Broadest product range

Andermatt Group network

- Global expertise of biological experts
- Knowledge transfer within network
- Local support through subsidiary companies and partners in over 60 countries



What is a baculovirus?

- The term baculovirus includes both granulovirus (GV) and nucleopolyhedrovirus (NPV).
- Baculoviruses are ubiquitously and naturally occurring pathogens of certain insects, mainly lepidopteran species.
- Baculoviruses have a unique mode of action and belong to IRAC mode of action class 31.

Are baculoviruses toxic?

- No, baculoviruses are not toxic. They infect and cause disease in the host, without producing metabolites or toxins.
- A baculovirus offers highly specific pest control, targeting one or very few closely related insect species. Therefore, baculoviruses have no adverse effects on beneficial insects, plants, mammals or aquatic organisms (see table below).

Key take out: Baculoviruses are safe for the user, consumer and the environment. They act specific against certain insect species.

Overview of various chemical and biological insecticides (including baculoviruses) and its toxicity on several important beneficial insects.

Beneficials IRAC MoA Nr.	Baculoviruses 31	Bacillus thuringiensis 11A	Beauveria bassiana* –	Spinosad 5	Neem oil –	Pyrethrins 3A	Vegetable oils –	Mineral oils –	Stone dusts –	Insecticidal soaps –	Avermectins 6	Diamides 28	Insect Growth Regulators –	Neo Nicotinoids 4A	Organo-phosphates 1B	Oxadiazins 22A	Pyrethroids 3A	Pyrroles 13	Semicarbazone 22B	Thiocarbamate –
Parasitoids	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Predatory mites	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Lacewings	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Ladybirds	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Flowerbugs	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Earwigs	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Bumble bees, bees	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Water organisms	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

*Toxicity strain/product dependent

Andermatt Biocontrol Suisse- content has been compiled to the best of the company's knowledge from reviewed research papers and the IOBC pesticide side effect database - no guarantee for accuracy and completeness can be given.

Level of Toxicity/Mortality
per Application

● 0–30% low

● >30–70% medium

● >70–100% high

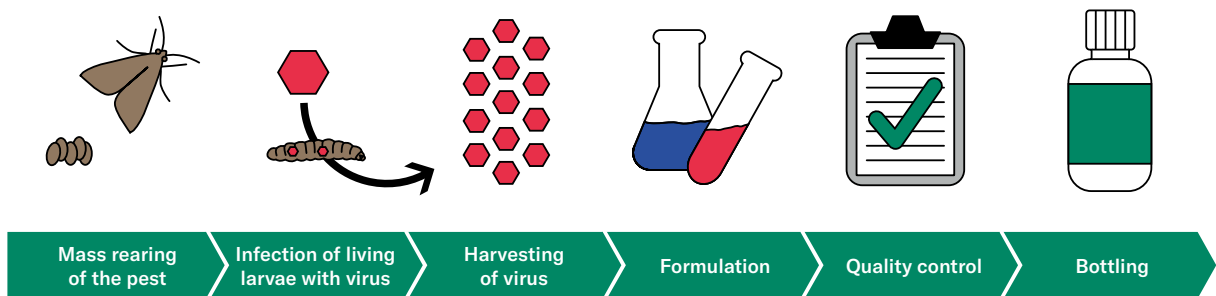
● no data



Andermatt

How are Andermatt's baculovirus products produced?

- Andermatt's baculovirus products are produced in living insects. Optimised and standardised production processes and an inhouse Research and Development department with extensive knowhow in insect rearing and baculoviruses ensure high stability of product quality.
- Every batch undergoes a strict quality control procedure including testing for activity in bioassays and contaminant screening.
- Andermatt's baculovirus products are produced in Switzerland and Canada.
- Andermatt Biocontrol Suisse is a manufacturing subsidiary within the Andermatt Group, dedicated to the development, production and application strategies of baculovirus products since 1988.
- Andermatt Canada is a development and manufacturing subsidiary within the Andermatt Group, dedicated to providing application strategies of baculovirus products since 2006.

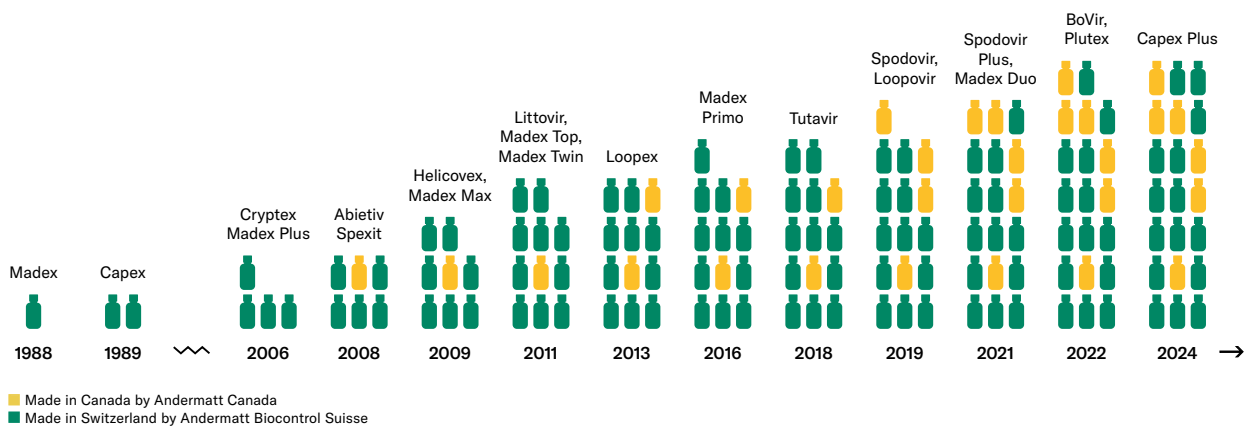


Which baculovirus products are available by Andermatt?

There have been over 20 baculovirus products developed within the Andermatt Group. Many additional projects are in the pipeline to complement the broadest baculovirus portfolio available worldwide.

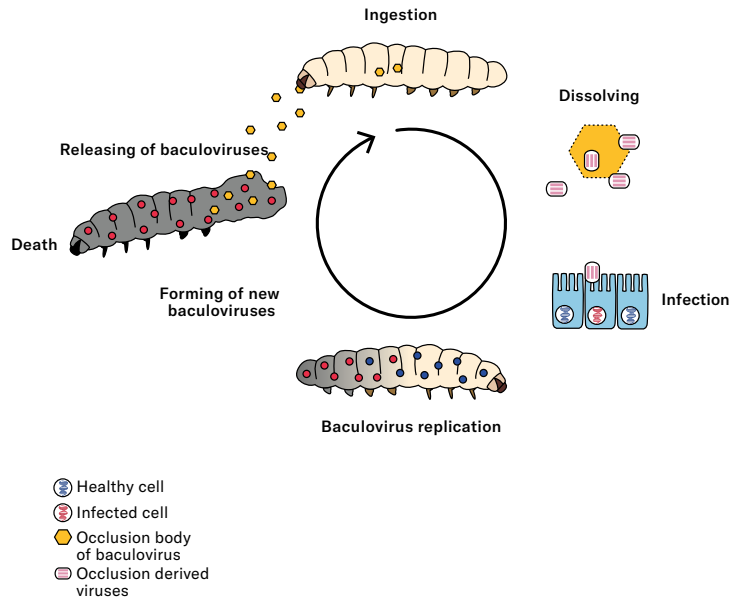
Key take out: Andermatt offers the widest range of commercially available baculovirus products worldwide.

The Andermatt baculovirus products have been registered in over 50 countries with many registrations pending worldwide.



How does a baculovirus work?

1. The virus particles (occlusion body = OB) must be ingested by the host larvae.
2. The protein capsule of the occlusion bodies is dissolved by the high pH of the larvae's midgut.
3. The infective part of the virus is released (occlusion derived virus, ODV), enabling the primary infection of the midgut cells.
4. Replication takes place in the nuclei of the midgut cells, followed by cell-to-cell infection of the entire larva.
5. 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.
6. In the occlusion bodies, the virus is able to survive natural environmental conditions.



How can baculoviruses affect an insect population?

Baculoviruses express four effects on the host larvae when applied in the field. Depending on the initial size of the larvae and the ingested amount of virus particles, different effects can be observed:

Direct effect

Direct effect on larvae present in the field. The larvae die after ingestion of the treated plant material.

Horizontal effect (horizontal transmission)

Upon death, the larva ruptures, occlusion bodies are released in the field and may cause new infections.

Fitness effect

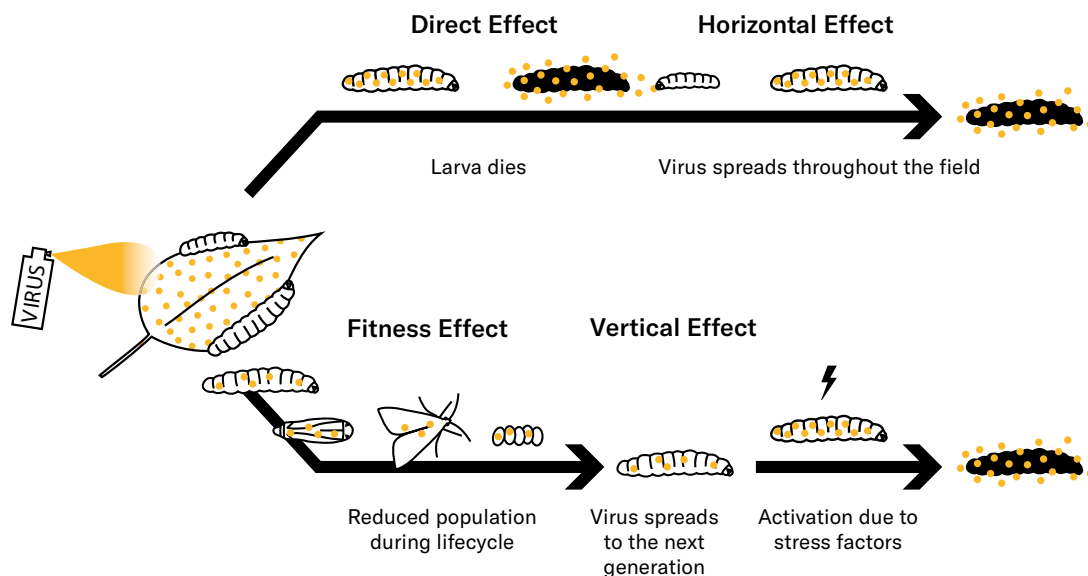
A sublethal virus infection can occur late in the life cycle of the target pest, with late larval instars ingesting few baculovirus particles leading to a

sublethal dose rate. The population growth of the treated generation is reduced, e.g. pupation rate and pupae hatching rate is decreased with baculovirus infection.

Vertical effect (vertical transmission)

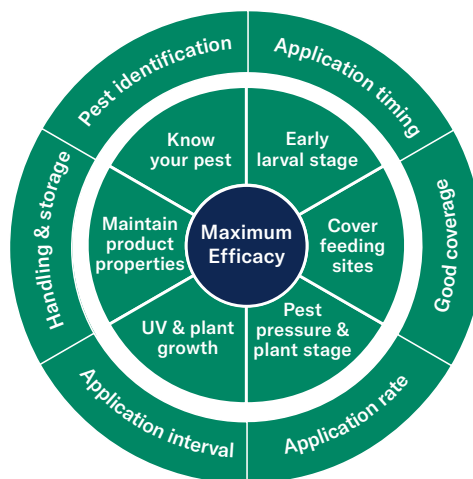
The baculovirus is transmitted to the next generation. Thus, next generation larvae may carry a viral infection which can break out after activation through stress factors (e.g. heat, food scarcity, other plant protection products etc).

Key take out: The population effect is a combination of the horizontal effect, vertical effect and fitness effect. The population effect is almost unique to baculoviruses.



How to apply a baculovirus product?

For optimal application to gain maximum efficacy of baculovirus products, the following factors should be taken into account:



Pest identification: How to choose the correct baculovirus product?

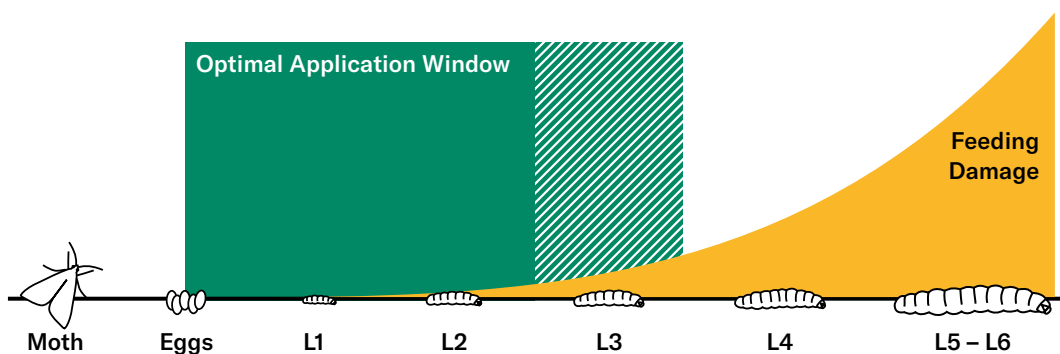
- Because each baculovirus product is effective on one or a few insect species only, it is essential to correctly identify the pest present.
- Common identification methods for insects are in-field scouting and monitoring traps (pheromone, sticky, black-light etc.).

Key take out: Baculovirus products act species-specific. Choose the matching product to the pest in the field.

Application timing: How to determine the best time for application?

- Target eggs and first larval instars (L1–L2).
- Mortality of small/young larvae is quicker and results in less crop damage than larger/older larvae.
- Larger larvae incur quicker and more extensive feeding damage on leaves and fruits.
- Some species feed on eggshell during hatching (e.g. *Helicoverpa* spp. and *Spodoptera* spp.). In these cases, the application on eggs can be useful to infect hatching larvae. However, the applied baculovirus does not have an effect on the egg itself.
- Temperature affects the development rate of the pest. At higher temperatures, most pests develop more quickly until feeding is stopped if it gets too hot.
- To identify the right moment of application, the pest population should be monitored. Common monitoring methods for insects are in-field scouting and traps (pheromone, sticky, black-light etc.) and local pest models.

Key take out: Start to apply product with hatching of eggs and cover the whole larval hatching period.



Good coverage: Why is good spray coverage essential?

Baculoviruses need to be ingested by the larvae. There is no systemic or translaminar effect of baculovirus products.

Thus, optimal application technique can significantly increase product efficacy.

Important questions to define which plant parts need to be sprayed:

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

Water volume should be adjusted to crop and spray equipment to allow good coverage, also of underside of leaves, but avoid run-off.

Key take out: The baculovirus product needs to be ingested by the larvae to have an effect. Good spray coverage is essential.



Good spray coverage



Bad spray coverage



Should an adjuvant be used when spraying Andermatt's baculovirus products?

No, it is not necessary to add an adjuvant. Andermatt's baculovirus products are ready to use:

- UV protection is included.
- Feeding stimulants, surfactant/wetting agents or other adjuvants have not reliably demonstrated additional efficacy.
- However, non-ionic or oil-based spreader or sticker may be used on crops with waxy surfaces (e.g. Brassica).

Application rate & interval: How to choose the application rate & interval of a baculovirus product?

- There are various factors determining the optimal application rate and interval including UV radiation, plant growth and pest pressure (see table below).
- Frequent applications at lower rates may be more effective than few applications at higher rates.

❗ For more specific information, please refer to the respective product.

	Application rate	Application interval
High/large 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 application interval
 ↓ Lower application rate ↓ Shorter application interval

Application interval: Does temperature or UV radiation affect the baculovirus?

- During storage, temperature is the critical factor affecting the viability of the product (see shelf-life recommendations below).
- Once applied in the field, UV radiation affects the viability of the baculovirus particles more quickly than high temperatures.
- Sprays are recommended when the pest is actively feeding, preferably at times of lower UV radiation (e.g. evening).

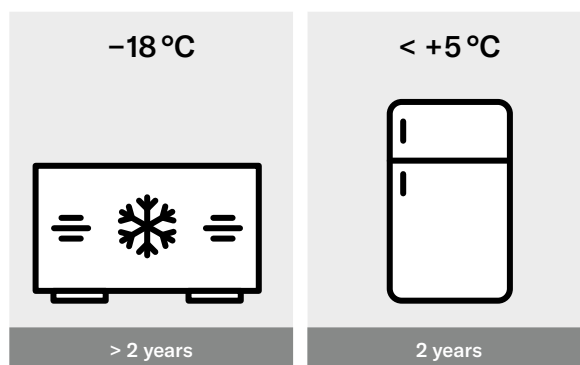


Application interval: Should the product be re-applied after rain?

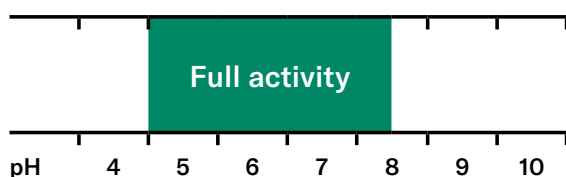
- No, once the product has dried on the plant, it is rainfast and thus compatible with rain and irrigation.
- Lipophilic properties of the baculovirus and the specific formulation ensure strong adherence to leaf surface.

Storage and handling: For how long can Andermatt's baculovirus products be stored?

- The products should be stored as cool as possible, preferably in the freezer.
- The product remains liquid when frozen and is ready to use without unfreezing.
- Once opened, the bottle can be stored further at low temperatures without loss of quality.
- Temperatures above 40 °C must be avoided. E.g. product should not be left in a parked car.
- At room temperature (25 °C) the products have a shelf-life of 1 to 3 months, depending on the specific product. Consult the respective product information.



Storage and handling: Can Andermatt's baculovirus products be tankmixed with other products?



- Yes, they are compatible with most insecticides, fungicides and fertilizers as long as a pH level between 5 and 8.5 in the tank mix is respected.
- Restricted compatibility may occur for copper products as well as acidic (pH < 5) and alkaline (pH > 8.5) products. The compatibility list should be consulted before mixing such a product.
- The baculoviruses should not be mixed with concentrated products and be applied as soon as possible after mixing.

❗ For more specific information, please refer to the respective product.

Healthy Food and Healthy Environment, for all