



Suppressing Resistance with Multi-Action Biopesticides

Dr John Sorenson, CEO at Vestaron, spoke to *Speciality Chemicals Magazine* about the company's new range of dual- and triple-action biopesticides.

Emergence of bio-power

The development of new food safety regulations in the past decade resulted in the withdrawal of many synthetic substances used in plant protection products.¹

Biopesticides are pest-controlling substances that are derived from natural materials: microbial pesticides use living organisms such as bacteria, fungi, protozoans and yeasts, while biochemical pesticides use naturally-occurring compounds that control pests by non-toxic mechanisms. As well as being 'friendly' to non-target organisms, and reflecting their natural origins, biopesticides produce no harmful residues. Therefore, in a world that is increasingly sensitive to issues of regulation, pollution and sustainability, they have received a great deal of attention as substitutes to synthetic chemical plant protection products.



John Sorenson,
CEO at Vestaron

John Sorenson, Vestaron CEO explained, "The past decade has seen a strong move to less hazardous insecticides. Biological insecticides have advantages for human and environmental safety, but have suffered from reduced effectiveness in controlling insect populations. Our new generation of biological insecticides are just as effective as the harsher chemicals while maintaining the non-toxicity to non-target organisms. We're excited to be bringing this new kind of biologicals to the market."

Resisting control

A major challenge for farmers – whether using biopesticides or synthetics – is the development of resistance. If the target organism is not exterminated (or rendered incapable of reproduction) survivors may acquire tolerance and resistance, resulting in an evolutionary arms race.

A common answer to this challenge is to present more than one site of attack – dual- or triple-action products may have markedly more efficacy than those with just one mechanism of action. As quipped in a recent article by scientists at Dow and Bayer, "Diversity is the spice of resistance management by chemical means".²

"An added plus of our new chemistry is that we have two modes of action to provide built in barriers to insects developing resistance to our product," said John. "This is very unusual for synthetic or biological chemistries."

Venom peptides

Vestaron has just launched their first GS-Omega/Kappa-HXTX-Hv1a biopesticide. Known commercially as 'Spear', this range uses technology that employs naturally-occurring venom peptides that form the basis of a highly specific, environmentally benign bioinsecticide. GS-Omega/Kappa-HXTX-Hv1a has insecticidal activities against a wide range of arthropod pests, including the orders of diptera (flies), lepidoptera (caterpillars), coleoptera (beetles), orthoptera (locusts), blattodea (cockroaches) and Acari (mites and ticks).

In target organisms, GS-Omega/Kappa-HXTX-Hv1a is a neurotoxin.³

- Phenotypic symptoms: uncontrollable spasms and loss of movement coordination, followed by paralysis and death (at low doses)
- Neuromuscular effects: rapid paralysis and death (at high doses).

Electrophysiology experiments indicate that it acts through isolated effects on calcium-activated potassium channels (BK_{Ca}) and voltage-dependent calcium channels (Ca_v), making it a dual-action toxin.

John explains, "The insecticide is a small peptide (molecular weight [MW] approximately 4,500) which is about mid-way between synthetic chemicals (about 200-300 MW) and traditional biological insecticides (*Bacillus thuringiensis*, about 135,000 MW). It truly represents a new class of biological control agents."

The novel toxin has been developed into three products. The products' two or three novel modes of action will help to delay the emergence of insect resistance, while enhancing performance:

- Dual-action SPEAR-T: GS-Omega/Kappa-HXTX-Hv1a active alone for control of thrips and whiteflies in glasshouses. Mode of exposure is primarily by contact. Commercial availability early 2017.
- Triple-action SPEAR-C: GS-Omega/Kappa-HXTX-Hv1a active co-formulated with *B. thuringiensis* variety kurstaki (Btk) for control of caterpillars. Mode of exposure is primarily oral ingestion which is facilitated by perforation of the gut by the *B. thuringiensis*. Commercial availability late 2017.
- Triple-action SPEAR-P: GS-Omega/Kappa-HXTX-Hv1a active co-formulated with *B. thuringiensis* variety tenebrionis (Btt) for control of Colorado potato beetles. Mode of exposure is a mixture of contact and oral ingestion. Commercial availability early 2018.

Sustainability

The Spear product line is non-toxic for fish, birds, humans and other mammals, honeybees and other beneficial insects. Field trials have demonstrated results equivalent or superior to conventional control chemicals.

John commented, "Sustainability has become very important, not only to consumers, but to farmers. Farmers no longer have to choose between safety and sustainability on the one hand and effectiveness on the other."

In July 2016, Vestaron's Spear-T [dual action] bioinsecticide was granted MPS Sustainability Certification, reflecting the sustainable nature of the product. Netherlands-based MPS ('More Profitable Sustainability') is a market leader for registration and certification in the international horticultural sector. Worldwide more than 4,000 companies (growers, wholesalers, retailers) participate in MPS in more than 40 countries.

Summary

John concluded, "Vestaron is very excited about bringing the Spear product line to farmers and consumers alike. The advantages of bringing products to market which combine the properties of biologicals and the effectiveness of synthetics and have built in safeguards against the rapid development of insect resistance to them is truly remarkable. These products represent a real win for growers who are looking for sustainable and effective solutions to their insect control problems!"

Vestaron is also developing the next active ingredients to follow the Spear products that have the same advantages for the market. The supply of peptides that exist in nature to continue the expansion of their products is vast, and the company anticipates a steady stream of effective sustainable products in the future.

REFERENCES

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