

Spotlight on sucking insects

Effectively controlling insect pests without damaging the majority of beneficial organisms: this is the tricky balancing act which Bayer CropScience's researchers have pulled off to a high standard with their new insecticide Sivanto™. Its discovery was inspired by previously described molecules and an insecticidally active natural product. The first registrations are expected in 2015.

The invasion usually goes completely unnoticed at first. This is because the invaders are only a few millimeters long, but they are extremely destructive: when aphids, hoppers or white-

agricultural biologist working for Bayer CropScience. This is why Haas and his team always require new active substances and mechanisms so that they can control insects that harm fruit and vegetable crops but leave those that are useful unscathed. "We need insecticides that are highly selective; in other words, basically insecticides that are able to differentiate beneficial insects from pests."

The latest product to emerge from the labs of Bayer CropScience is the insecticide Sivanto™, a member of the new class of butenolide insecticides. Bayer's scientists have cunningly combined three different components to create the new active substance flupyradifurone (Sivanto™). They discovered one of the building blocks, the butenolide moiety, in previously described molecules and in nature: Asian researchers had identified a promising ingredient in *Stemona japonica*, a medicinal plant that grows mainly in South East Asia. Stemonofoline is an alkaloid with exciting insecticidal properties. But for decades attempts made by scientists around the world to use this knowledge to develop a commercial crop protection product failed. Bayer's research scientists have now succeeded: "The skill lay primarily in identifying which part of this complex natural product was responsible for its insecticidal action," explains chemist Dr. Robert Velten.

The team combined this butenolide moiety with two chemical fragments to further boost the efficacy and selectivity of the active ingredient. In addition to the moiety deduced from nature, Sivanto™ also contains a chlorinated pyridine ring which has already been found to be effective in other insecticides and a completely new group to be employed in a crop protection active ingredient: a short fluorinated carbon chain. Achieving the desired level of selectivity was the biggest challenge: "We spent years making numerous compounds and sending them out to biologists and biochemists via our substance library," explains Velten.

But all their hard work paid off, as Sivanto™ will offer fruit trees and vegetable plants reliable protection against pests, and has an excellent environmental profile.

The lab work was inspired by natural products

"The new substance has exceeded all expectations – above all in regard to its environmental properties," comments Dr. Klaus Kunz, the project leader at Bayer CropScience. It is degradable and non-hazardous to humans and a wide range of beneficial organisms if used correctly. Another advantage of Sivanto™ is that it controls pests that have become resistant to many commercialized insecticides. And

42
percent

of global crop production is lost to insects, weeds and plant diseases each year.

flies reproduce at enormous rates in tomato, apple or citrus crops, it doesn't only lead to smaller harvests. The tiny invaders also make crop plants more vulnerable to fungi, viruses and bacteria. Fruit and vegetable growers all over the world need to defend their crops against these and other insect pests. However, although some insect species cause great harm, others are vital for plant pollination: "Beneficial organisms like bees and other insects are also buzzing around the plants, pollinating the flowers and making a good harvest possible," explains Dr. Matthias Haas, an



Crop protection scientists: agricultural biologist Dr. Matthias Haas (photo, left) examines the effect of the new insecticide on pests attacking young vegetable plants at Bayer CropScience's greenhouse in Monheim. Once aphids have discovered a new food source, they breed rapidly (photo, below right). Chemist Dr. Robert Velten and engineer Valentina Neufert (bottom photo, left to right) are working in the lab to improve the structure of insecticidal active substances so that they control pests without harming beneficial organisms.



farmers can develop completely new, more effective spray sequences for their crops. As Kunz points out, "Sivanto can be applied when crops are in blossom, unlike many other insecticides."

Most of the beneficial organisms tested tolerated the new active ingredient well in numerous studies carried out in the lab, the greenhouse and in field trials. The active ingredient is now being registered around the world.

Bayer's experts expect the first launch in 2015. "This product also complies with the new, more stringent requirements for insecticide registration," explains Kunz. He sees the new insecticide as a further element in Integrated Pest Management, in which all modern crop protection methods are combined in the most effective way to secure harvests for farmers. His goal: safe harvests for fruit and vegetable growers around the world.



Tricks of nature

Plants have developed a number of defense mechanisms to avoid being eaten. They produce bitter substances designed to spoil the appetites of hungry caterpillars, or emit scents that attract the pests' predators. Many plants also have a repertoire of insecticidal substances: for example, rapeseed oil contains fatty acids that kill sucking pests but leave beneficial organisms unscathed. Chrysanthemums produce pyrethrum, a powerful natural insecticide. These and other natural models can be used to develop effective crop protection products, and also to breed better crop varieties.



www.research.bayer.com/sivanto

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