Aphid control: partner with nature to keep improving solutions for growers

At Koppert Biological Systems we do everything possible to ensure that our products reach growers in the best possible condition and ready to do their valuable work upon arrival. In our series on ‘Koppert Quality’ we now focus on the biological control of aphids.

Aphids present growers with an increasing number of problems and Koppert is continuously working to find sustainable solutions to control a wide range of these small bugs which feed by sucking sap from plants and reproduce rapidly.

An integrated approach

The reason why aphids represent such a problem in crop production is that they comprise one of the most species-rich group of pests. Worldwide, there are approximately 5000 aphid species, of which 450 species affect commercial crops.
Since it is common for a crop to be simultaneously attacked by several aphid species, the possibility of controlling aphids with a single solution is often limited. Growers therefore need to deploy a combination of products to effectively suppress and control aphid infestations. The complexity of the problem that aphids represent makes it essential that Koppert’s R&D Macrobial and Microbial departments continue to improve existing solutions, and explore new solutions for aphid biocontrol.

Parasitoids are very efficient in locating aphids at the very beginning of an infestation, before a pest situation occurs. In contrast, predators like lacewings are much more voracious and effective in cleaning up hotspots of infestations. Predators are therefore very suitable to be used curatively, whereas parasitoids can be efficiently used at an early stage of pest development or even preventively. This argument underlines the fact that parasitoids should be viewed as complementary solutions to control aphids and not as the choice of using either one of them.

‘We have observed a trend in biocontrol towards the use of generalist predator insects,’ says Koppert’s Product Manager Tim Bossinga. ‘However, this does not mean that our parasitic insects and microbial solutions are not needed as well. It’s important to aim for an integrated approach. Today, our products provide a wide range of high-quality biological solutions that control the most prevalent aphid species.’

Product differentiation

There are many different aphid species that affect a variety of crops in many different conditions. So how to make the right choice of products for controlling this pest? Each product has its own specific application, so it is important to use it in the right situation. Devising an integrated biocontrol plan is essential. A Koppert consultant can help to build this plan which often stretches over many weeks and contains several products.

‘Because of the differences in these products, the knowledge of a professional is vital,’ advises Koppert’s Technical Consultancy Manager Ornamentals, Vince van der Gaag. ‘Growers can then carry out a steady course and strategy instead of ad hoc decisions, which more often than not, end up in unwanted results. With aphid control it’s important to work proactively, so a good plan is crucial for these preventative actions.’

Effective biological control of aphids often means using more than one product. The table below shows the different products available and their specific applications.

Product	Type	Generalist / Specific	Extra info
Aphidend	Gall midge	Generalist	Aphidend larvae carry a certain poison that kills the aphid when it is perforated. Aphids are then being consumed by the Aphidend larvae. Adults place eggs nearby aphid populations. The generalist gall midge can be applied to the most prevalent aphids. Aphidend is susceptive to low humidity levels and colder temperatures.
Aphipar + Aphipar M	Parasitoid wasp	More suitable for control of smaller aphid species.	The larvae consume the aphid from within. Larvae turn into pupae (mummies), followed by adult stage, the next generation. Aphipar M has the most specific application for Myzus species.
Ervipar	Parasitoid wasp	More suitable for larger aphid species	The larvae consume the aphid from within. Larvae turn into pupae (mummies), followed by adult stage, the next generation.
Chrysopa	Lacewing	Generalist	Both the larvae and eggs can be applied. The larvae are the effective stage of this generalist predator.
Aphiscout	Mix of 5 Parasitoid wasp species: (Aphipar, Ervipar, Aphilin, Praon and Ephedrus:		Use this product when you are not sure which species of aphid you are dealing with. The colour the aphid turns into will give you an indication which is most effective. Aphilin turns the aphid black, and Ervipar/Aphipar leatherbrown. Use AphiScout first and then a more specific product.
Aphilin	Parasitoid wasp		This parasitoid wasp is often used in combination with Aphipar or Ervipar.

Quality raw materials

‘We use the best raw materials available and demand high quality from our suppliers,’ says Koppert’s Production Manager Macrobials, Koos van Spronsen. ‘We are extremely conscious about the quality of these natural products and they are monitored daily. There can be no impurities or chemical residues in the materials and suppliers need to maintain a specific and consistent quality as standards need to be maintained and reliable stocks assured.’

Counts are carried out continuously during the rearing process of these beneficial insects or macrobials. ‘We have daily insight into how our macrobials are developing,’ Koos explains. ‘If there is an enquiry from a grower, we are able to trace it back to a specific batch immediately and, if necessary, rectify issues on the spot.’

Transportation and logistics checks and controls

‘We transport our biological products as larvae or pupae, depending on the product. This means that a specific range of temperature needs to be maintained during transportation,’ Tim explains. ‘Logistic partners that transport our products across the world are given very specific expedition instructions. Even the way in which the trucks are loaded is specified, again allowing for ventilation for the living organisms.

Freight carriers are carefully selected so that logistics flow smoothly and climate conditions are maintained at the right levels throughout the journey. All orders carry log tags with sensors that record temperature, humidity and CO_2 levels.'

On arrival at Koppert warehouses or distributors, the orders are checked for any signs of non-conformity (any deficiency in characteristic, documentation, or procedure of quality). Log tags are read and quality checks are carried out according to strict procedures. The order is then stored in climate control rooms or transported to the end-user in climate-controlled conditions. The growers themselves have been instructed by professional consultants to introduce the beneficial insects into their crops as soon as possible. Should the order have been compromised anywhere, there are clear-cut procedures and global quality support officers to deal with the necessary customer communication and possible complaint analysis by our Complaints Department.

Once they arrive at their destination, they need to be released in the crop immediately following strict instructions. Detailed information is available when it comes to the application of our macrobials, including 'how to' videos on our YouTube channel and our dedicated websites.

Exploring microbial solutions

Complementary to insect- and mite-based products, the Business Unit Microbiology is further developing and thoroughly testing another promising sustainable biological solution to control aphids, entomopathogenic fungi (EPFs). Entomopathogenic fungi such as *Beauveria* spp. and *Lecanicillium* spp. can play an important role in pest control by controlling diverse aphid species. These fungi are suitable for sustainable agriculture as they are not pathogenic to humans and are not known to negatively impact the environment. After spraying, the fungal spores germinate and grow on the insect cuticle, producing hyphae that penetrate the body cavity of the pest insect. As the mycelium grows, it destroys the insect body tissues leading to its death. The fungus then grows through the insect cuticle and produces spores on the outside of the cadaver that spread the infection to other insects (*Figure 1*).

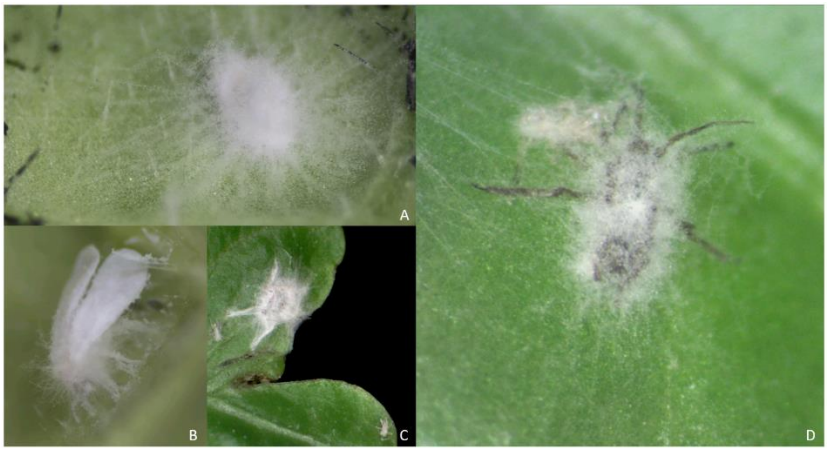

Figure 1: Insects infected and killed by entomopathogenic fungus. A-B) Whiteflies (Trialeurodes vaporariorum) covered in sporulating fungus. C-D) Aphids (Myzus persicae) killed by entomopathogenic fungus. Photo credits: Lisa Tonino, Microbiology, Agronomical Development NL.

Koppert EPF products are currently used to control whiteflies, weevil, mites and thrips. The Agronomical Development groups at Koppert are now exploring the potential of existing EPF products for the control of aphids. 'The first results are very promising,' says the lead of the Dutch team Roxina Soler. 'One of our products, significantly reduces the level of aphids at different doses, and importantly this EPF can grow at a wide temperature range (*Figure 2*) covering the variety of crops where it can be applied.''

The outcomes of this research are expected to lead to extension of labels for the existing EPF products and eventually registration of new developing products.

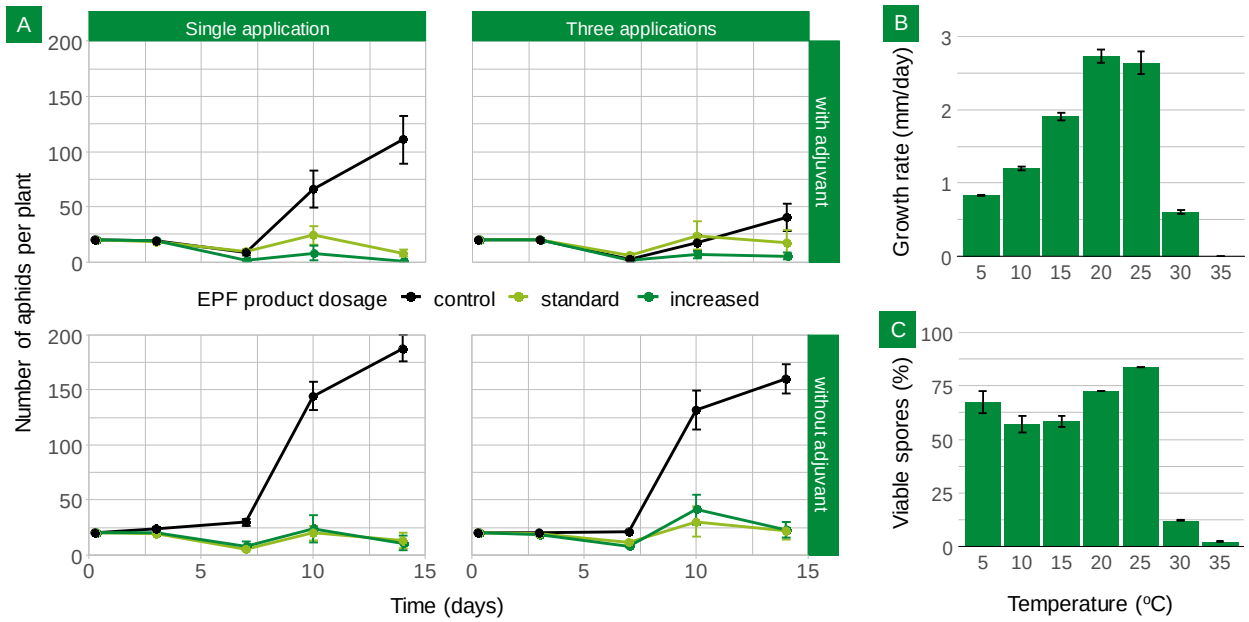

Figure 2: Efficacy of an EPF product to control aphids and growth at a wide temperature range. A). EPF product significantly reduces the number of aphids at different doses (standard and increased doses), with and without addition of adjuvant (horizontal panes) and independent of number of applications (vertical panes) compare to control treatment. B-C) EPF growth and spore viability at different temperatures.

In the light of this topic series that refers to quality, it is interesting to say few words about the quality of the research that we target at Koppert', Roxina continues. 'Our research pipeline starts with developing scientifically sound protocols at the innovative laboratory facilities, and is scaled up through modern climate cells, experimental greenhouse to the commercial greenhouses and open fields (example shown in Figure 3). This process enhances our understanding of the products, the 'know-how', resulting in high quality end products'.

Figure 3: Laboratory and Climate Cell experimental trials. Model plants sweet pepper (A,C) and cucumber (D,E) infested with green peach aphid (Myzus persicae) as first model aphid species.