



New Eawag spin-off: Creating value from organic waste

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Thanks to many years of research at the aquatic research institute Eawag, biologist Stefan Diener and environmental scientist Bram Dortmans know how to turn organic waste into valuable feed with the help of black soldier flies. Together, they have founded the spin off Eclose to put their expertise into practice.

From spoiled fruit, chicken manure, or brewer's spent grain to restaurant, market and slaughterhouse waste, there is virtually no organic waste that the larvae of black soldier flies (*Hermetia illucens*) will not eat. "They will even feed on lawn clippings," says biologist Stefan Diener. "Then it just takes a few more days for them to reach their maximum weight." Diener joined Eawag's Department of Sanitation, Water and Solid Waste for Development (Sandec) in 2005 to research how best to breed the insect as part of a PhD thesis. "At Eawag, we were among the first in the world to conduct research on this topic," he recalls.

The main focus was actually to solve a waste problem that many countries in the Global South face. While there is an informal value chain for waste types such as paper, cardboard, plastic or metal, organic waste there often ends up in landfills. If they are fed to the larvae of the black soldier fly instead, they can reduce the volume of the waste by up to 70 percent. What remains can be used as organic fertiliser, similar to compost. And last but not least, the larvae themselves can be harvested at the age of two to three weeks, then cleaned, dried and sold. Thanks to their high protein and fat content, they represent a valuable feedstuff in fish or chicken farming, for example, and can replace fish meal.



Bram Dortmans portions five-day-old fly larvae before adding them to organic waste (© Eawag).

Demand for consulting

“Insect breeding has the potential to add value to organic waste and create jobs at the same time,” says Diener. There is great interest in this topic. The step-by-step guide “Black Soldier Fly Biowaste Processing”, first published in 2017 and revised in 2021, which he co-authored, has been downloaded over 20,000 times worldwide, he says. Eawag now also receives almost a hundred enquiries per year from numerous countries, for example, donors who want to know whether investing in a particular installation is worthwhile, fish or chicken farms that want to produce their own feed locally, or companies that have large quantities of organic waste they want to use.

“This consulting goes beyond Eawag’s mandate,” says Diener. To be able to provide this service and put his knowledge into practice, he finally founded the spin-off Eclose in August 2021. His business partner is the environmental scientist Brams Dortmans, who set up a pilot plant for waste recycling with black soldier flies in Indonesia and operated and further developed it for six years in the Eawag-project FORWARD. Eclose is a technical term that means “to hatch” or “to emerge”, says Diener, explaining the spin-off’s name: “This is exactly what we want to achieve with our consulting: we help business ideas develop into mature projects and eventually become a reality.” The focus is on low-tech installations in countries of the Global South that process between 10 and 50 tonnes of organic waste per day.

“In order to operate an installation commercially, it has to be of a certain size,” explains Diener. One of the biggest challenges in setting up a commercial bioconversion facility is the provision of organic waste. “It has to be available constantly and in consistent quality. This is

often underestimated.” Especially when it comes to fruit and vegetable production and processing, where large amounts of organic waste are sometimes produced, the seasonal fluctuations are great, he says.



Black soldier flies mate and lay their eggs in what are known as “love cages” at an installation in Kenya (© Eclose).

Darkrooms and “love cages”

Another challenge according to Diener: “Our research at Eawag has shown that we need to take full control of the flies’ cycle.” To treat ten to 20 tonnes of waste per day, dozens of millions of fly larvae have to be produced every day. To achieve a synchronized harvest, it's crucial that they are all of a similar age when put on their food. To achieve this, Diener says a special light-darkness regime and a clear work schedule to which all employees must adhere are needed. “We take advantage of the fact that black soldier flies only mate in sunlight,” the biologist explains. Boxes with fly pupae go into a darkened net. Only when the majority of the insects have eclosed are they lured into what is known as the love cage with light. “This allows us to plan to the day when the flies mate, when they lay their eggs and when the young larvae hatch that are needed to treat the waste.”

For the first two years, Diener worked for the spin-off in a limited part-time capacity. He will give up his position at Eawag altogether in October. He and his business partner will both advise investors, plan and optimise new installations, and train employees of these installations. If things go well, someday they want to build their own installations, where they will perform their own research, try new things and further develop the technology.



Stefan Diener and Bram Dortmans in August 2021 after the foundation of Eawag spin off Eclose (© Eclose).

Cover picture: Black soldier fly laying eggs (© Eawag).

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Contact



Cornelia Zogg

Science Editor

Tel. +41 58 765 5763

cornelia.zogg@eawag.ch

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