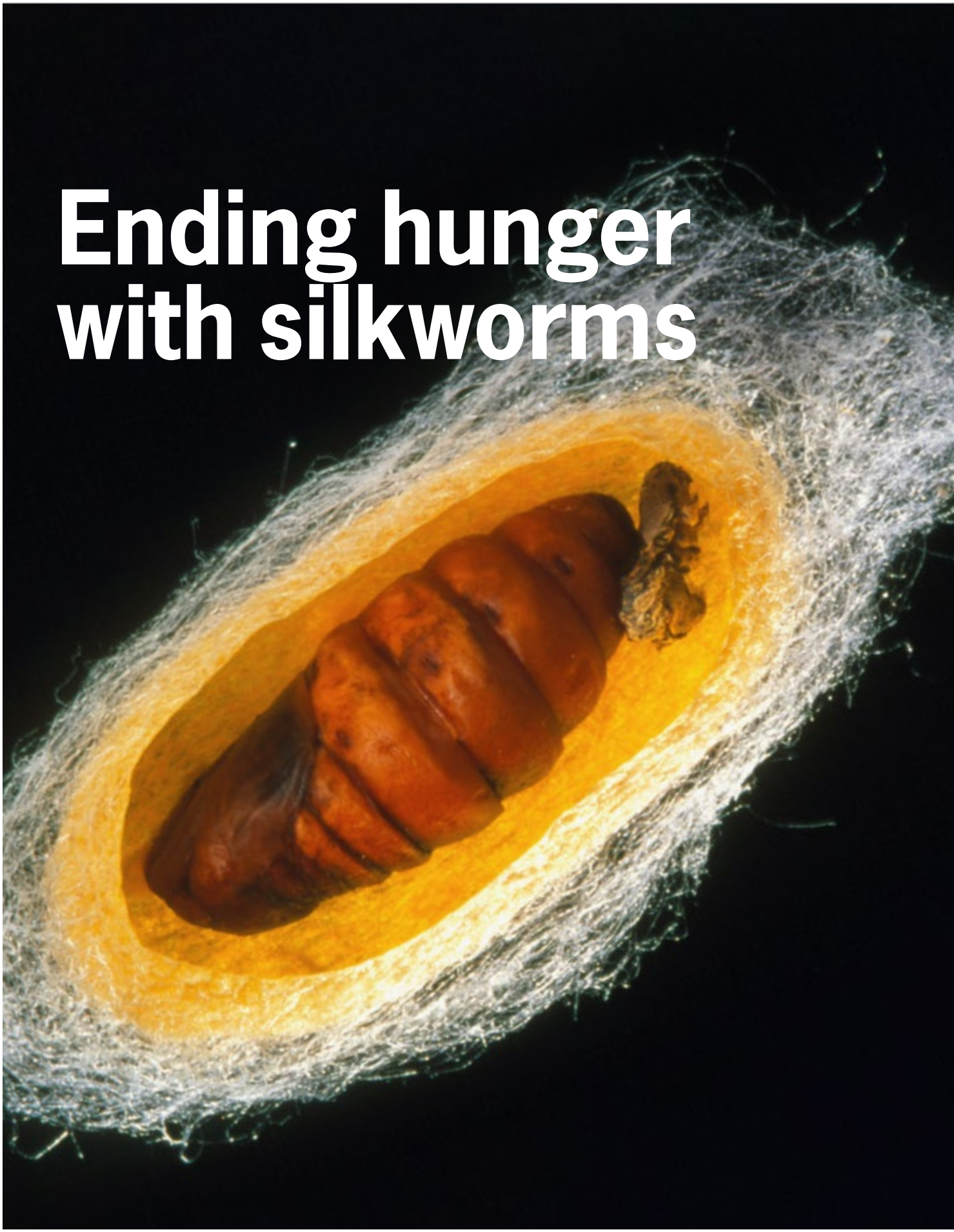
Ending hunger with silkworms



Students Anjani Nayak and Fabiola Neitzel want to use protein-rich silkworms to make hypoallergenic pet food and eventually to help undernourished children in India. They won a Wageningen student challenge with their business plan. 'We saw the final round as the finishing line but we've only got busier since then.'

TEXT TESSA LOUWERENS **PHOTO** ANP

'Every year the silk industry in India is left with about 250 million kilos of silkworm pupae,' says student Anjani Nayak. 'The farmers want to get rid of them before they rot, and they often sell them off at a low price for fish feed,' she adds. 'That is not allowed because it causes pollution and there are health risks when the fresh pupae sink to the bottom of fish-ponds and rot there.' Together with German student Fabiola Neitzel, Anjani came up with an alternative: processing silkworms into food for undernourished children in Anjani's home country, India. With this idea they entered the WUR Student Challenge ReThink Protein with this idea. And they won, though not before adjusting their plans in the face of hard realities.

Students Fabiola Neitzel from Germany (left) and Anjani Nayak from India dry, crush and mill the silkworm pupae into powder.

Anjani learned a lot about the silk industry as a Bachelor's student of Agricultural Sciences in India. She learned how silkworms flourish on mulberry leaves, how they spin cocoons of silk, and how to rear them. It was then that she developed a fascination with insects. 'On Google I came across a video in which Marcel Dicke, the Wageningen professor of Entomology, talked about edible insects. That is not customary in India and my first thought was: yuck! Then I started to read more about it and within a few weeks I was sure I wanted to specialize in edible insects.'

GERMAN INSECT FARM

After watching that video, what Anjani wanted most was to do a Master's degree in Wageningen, but that was too expensive. In the end she managed to arrange an internship at a German insect farm, where she met Fabiola. Thanks in part to a shared passion for insects, they got on well from the start and became firm friends. After their internship they both embarked on Master's programmes in Germany: Fabiola in Insect Biotechnology and Bioresources at the Justus Liebig University in Giessen, and Anjani in Plant Protection and Nutrition at the University of Hohenheim.

And then last year, Anjani did get to Wageningen for the Insects as Food and Feed summer school, after which she took several courses here as an exchange student. 'Then I even found an opportunity to do my thesis here, under Dennis Oonincx and Joop van Loon.' It was here that she heard about the WUR Student Challenge, ReThink Protein. In this international competition, students are challenged to come up with new ideas for feeding the growing world population (see inset). >

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'I thought of silkworms straightaway, but I wasn't sure if it was a good idea.' She got in touch with Fabiola, who was in China at the time, and she was enthusiastic. The deadline for submitting ideas was only a month away. Fabiola: 'Communication was a bit difficult at times because of the restricted access to the internet in China.' They worked on their proposal throughout December and in January their two-person team SWAP (Silkworm as Protein) was born.

'Insects are a healthy and sustainable source of protein,' says Anjani. 'They are expensive to farm because production is often small-scale and labour-intensive. But the silk industry already has thousands of years of experience in this area. The pupae are a by-product, so they are affordable, and by using them as food we help combat pollution.'

'Dried pupae contain up to 70 per cent protein'

They submitted their proposal after Christmas. 'We thought we had got quite far at that point,' says Anjani. But taking part in the challenge turned out to be pretty labour-intensive and the months that followed brought a series of deadlines, presentations and meetings. Anjani: 'Every now and then I wondered whether it wouldn't have been a better idea to focus on my Master's thesis.' The collaboration went smoothly in spite of their being more than 300 kilometres apart, Anjani in Wageningen and Fabiola in Giessen. And they were not without support. Fabiola: 'You have access to a platform on which you can get help from the participating companies. One of the coaches who helped us enormously is Derick Jiwan, manager at Hazel Technologies, a Chicago-based company that develops products for reducing food waste.' The team was also coached by organizations including Rabobank, Topstart, Nutreco and Nature 2.0. Fabiola: 'And we took part in seminars, on writing a business plan, for instance, and on finding funding.'

The students also had the chance to pitch their ideas to different companies and brainstorm with them. Anjani: 'We learned an awful lot from that, but we also found out that it's impossible to follow all the advice. In the end you have to make decisions yourself.'

The pair succeeded in creating their first prototype, a kind of protein powder. It turned out to be quite a job to get hold of the silkworm pupae. Anjani: 'Eventually we discovered that you could buy dried pupae as a snack on eBay in China.' Fabiola processed these pupae in the lab. 'The dried, defatted pupae powder contains up to 70 per cent protein. It is also rich in iron and essential amino acids, and it is a source of healthy omega-3 fatty acids.'

DEVASTATED

Everything went swimmingly until the team had to radically change their idea in the middle of the competition. Anjani: 'We discovered that selling insects for human consumption is prohibited in India.' They were devastated. 'We thought, well, we might as well pack our bags.' But in consultation with their coaches they decided to adapt the idea and focus in the first instance on the animal feed industry. 'Ultimately, it's all part of the competition that you learn as you go along and develop your idea,' says Fabiola. Anjani: 'In Europe alone, there are 360 million pets and with increasing prosperity in India, the number of pets there is growing too. Animal feeds based on insects are also a solution for pets that are allergic to beef or chicken, and for pet-owners who want sustainable pet food.' Fabiola: 'Pet food is more lucrative than livestock feed too, and you can produce it in smaller quantities.' They hope to scale up production later on, and to develop products for the livestock feed industry as well. Anjani: 'In the end, once we are established, the law has changed in India and eating insects is more widely accepted, we want to make

> ‘Several investors have shown an interest’

the shift towards products for human consumption.’ After an extensive quest, the pair have now found a local silk producer in India who is willing to sell them his pupae. Anjani: ‘On condition that we give him the same price for them as the fish farmers.’ Because the pupae rot quickly, they really need to be processed the same day. The businessman has offered them a room where they can set up their first production line. The students want to dry, crush and grind the pupae and sell the powder worldwide. This would make them the first producers of silkworm protein powder in India.

TESTING FOR SAFETY

The jury was impressed by the team’s thorough preparations and the fact that they had already given careful thought to how they wanted to market their product. They did ask a few critical questions, however, including about safety issues, given the large amounts of pesticide used in the silk industry. Fabiola: ‘We are aware of that and we want to use the next 12 months to further validate the processing method and to test the pupae from India in the lab for safety.’ They then want to start a small-scale pilot production project in India in 2020. If that goes well, they hope to process 100,000 kilos of pupae per year from 2021.

Winning the competition is by no means the end of the road, they realize. ‘All the time we saw the final round as the finishing line, but we’ve been even busier since then. Several investors, such as Rabobank and Nutreco, have already shown an interest,’ they say proudly. They want to use the 5000 euros prize money to fly to India together at the end of this year, partly so as to meet the local silk farmer for the first time. But first they’ve got Master’s theses to finish off. ■

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INTERNATIONAL STUDENT COMPETITIONS

The WUR Student Challenge: ReThink Protein is an international competition in which students are challenged to submit an idea or a prototype for providing the growing world population with protein that is sustainable, healthy and affordable. ‘Our aim is to stimulate enterprising students to further develop their ideas and talents,’ says coordinator Rio Pals.

58 teams submitted a first draft and 40 of them were given six months to hone their idea or prototype with the help of coaches from the business world and universities. The jury, made up of people from The Protein Cluster (TPC), Cosun, Nutreco, the ministry of Agriculture, Nature and Food Quality, DSM and Nature 2.0, selected the best teams on the basis of criteria such as innovativeness, sustainability and feasibility.

Team SWAP (Silkworm as Protein) won the final round on 27 June in the ideation category. The GrainGain team won in the Prototype category with their idea for processing waste streams from beer breweries into products such as energy bars. The winning teams receive 5000 euros and support from StartHub to continue developing their idea. The best WUR teams will compete with teams from other Dutch science universities at the 4TU innovation finals on 7 November.

The next Wageningen student challenge is the Urban Greenhouse Challenge, which starts in October this year in China.

PHOTO GUY ACKERMANS