



# ProciNut

Production and Processing of Edible Insects  
for Improved Nutrition

## Project update 2019

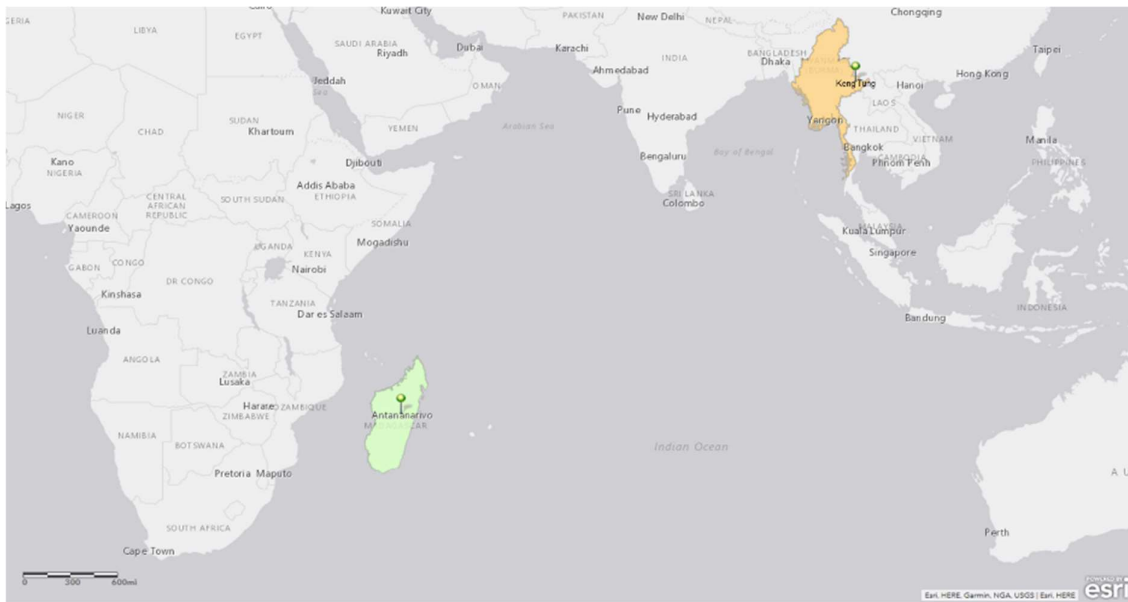
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## Project update

<b>Project title (Acronym):</b>	ProciNut - Production and Processing of Edible Insects for Improved Nutrition
<b>Geographical focus:</b>	Madagascar and Myanmar (and Thailand)
<b>Call reference:</b>	
<b>Cooperating partners:</b>	FOFIPA (Madagascar), HBRS-IZNE (Germany), INMU (Thailand), Spectrum SDKN (Myanmar), UoA (Madagascar), WHH (Madagascar), YAU (Myanmar)
<b>Duration:</b>	01.03.2018 – 30.06.2021
<b>Budget:</b>	1.065.052,16 € (as of February 2019)





Seite 3 von 10

#### **Aim of the project:**

The ProciNut (Production and Processing of Edible Insects for Improved Nutrition) project aims at better exploiting the nutritional and economic potential of edible insects. It tests different processing techniques of local insect species and expands commercial small-scale farm activities and processing to produce safe and nutritious end products that are able to close seasonal gaps, increase nutritional security of households and improve the economic situation of poor women in Madagascar and Myanmar.

#### **Results:**

After collecting data jointly for the two ex-ante studies, the work for ProciNut now continued more focused in the work packages, however intensive exchange and strategy development took place between the researchers from the different disciplines, also because results from one work package are needed to proceed in the other work package. For example, for the development of capacity development activities and training materials the data from WP 1 and WP 2 and intensive knowledge exchange are indispensable for efficiency of the activities, for adaptation of farmers and overall outcome of the project.

**Work Package (WP) 1:** While the fieldwork for the ex-ante analysis in Madagascar was finalized in 2018 and published in 2019 in form of a peer-reviewed paper by Dr. Jochen Dürr et al. in the International Journal of Tropical Insect Science, research activities for the ex-ante analysis in Myanmar continued until February 2019 and the respective report was finalized by the end of the year. This study investigated collection practices, production methods and the overall socio-economic contexts within different cities of Mandalay, Pyin Oo Lwin, Amayapura, Naung Cho, Myit Tha, Taunggyi and Kengtung. Especially perceptions of farmers on edible insects and potential production as well as knowledge gaps, training needs and cultural constraints were identified. In a next step, the detailed analysis of the socio-economic context, including institutional, food behavioural and value chain analysis was started based on the information gathered during the ex-ante period. The in-depth value chain and market analysis started in March 2019 in Myanmar by the doctoral student Ms. Myint Thu Thu Aung, supported by Dr. Jochen Dürr with 197 consumers (77 urban and 110 rural), one producer, 21 harvesters, six wholesalers, four local traders and six retailers in Kengtung area.. Consumer perceptions and behavior were investigated and value chains of the most popular insects identified and traced. The ex-ante data was also used for a follow-up research regarding the socio-economic context. A focus was put on the fact that people who like to collect and consume insects do not necessarily want to rear them. The main reason is lack of exposure and a missing perception on the possibility of insect rearing. Dr. Sarah Nischalke investigated this relevant research question for ProciNut further and it evolved into a research subject with expert interviews across the globe and four case studies from different countries that helped to identify the economic, ecological and socio-cultural challenges of transforming insect collectors and small entrepreneurs into mini-livestock farmers. The paper is accepted for publication in 2020 (Global Food Security Journal).

The fragmented landscape of insect producing activities, trainings and the inexperienced extension sector and policy environments along with the fact that the whole insect sector is extremely sensitive regarding competition and knowledge sharing, shows a strong need for the development of a long-term strategy of sustainably promoting insect consumption. Therefore, involved and interested stakeholders, were identified and in the case of Madagascar invited for regional and national policy events. Spectrum is very active in Myanmar in linking farmers, universities, development organizations and actors on policy level. They actively build awareness through briefing papers and materials such as recipe books and videos. Stakeholders in both countries expressed their interest to develop training materials jointly. In Madagascar, the agricultural ministry was especially interested in insects for feed such as the black soldier fly (*Hermetia illucens*) and in Myanmar, GIZ was interested in integrating contents on insects in their training materials for nutrition.



Seite 4 von 10

For the conduction of an extensive household survey in Madagascar (January 2020) logistics and contents (questionnaire) were prepared end 2019 by ProciNut intern Anne Meysing, Dr. Jochen Dürr and Dr. Sarah Nischalke.

**WP2:** In Madagascar, Mr. Andrianantenaina Razafindrakotomamonjy surveyed and identified wild edible insects present in the project region in Sandrandahi. He started rearing trials for three insect species for his doctoral research in the laboratory in March 2019 with wild silkworms (*Borocera cajani*), black soldier fly (*H. illusens*) and crickets (*Gryllus bimaculatus*). Silkworms were not fed with its usual host plant, the commonly eaten tapia leaves (*Uapaca bojeri*) but with guava leaves (*Psidium guyava*) which are more widely and abundantly available in the project region and throughout Madagascar. The life cycle, yield and rearing costs were investigated. With the black soldier fly, different substrates (kitchen waste versus green leafy vegetables combined with fish waste) were tested and their influence on life cycle, preference for egg laying and costs of rearing compared. In case of the crickets, tests were done comparing different feeds (rice bran, fish meal, corn powder) and their impact on life cycle and yield.

Christian Ratompoarison, the second doctoral student in Madagascar, researching insect processing, worked towards closing research gaps on nutritional composition of local edible insects with the four most commonly consumed species (wild silk worm, *Borocera sp.*, reared silk worm, *Bombyx mori*, nomad locust, *Nomadacris septemfasciata*, and the endemic cricket *Gryllus madagascariensis*). He did a proximate analysis looking at crude protein, fat, and ash and a qualitative analysis looking at aminoacids, fattyacids, chitin and minerals. Furthermore, he investigated the nutritional values and shelf life of insect flour (made from *Nomadacris septemfasciata*, *Gryllus madagascariensis*) of three different drying techniques: 1. steam blanching in combination of microwave drying, 2. frying and drying and 3. roasting and he assessed the consumer preference of three typical snacks from Madagascar that included insect flour with different proportions of 10, 20 or 30%.

He also established connections to a local bakery (Sao pain) and producers of typical snacks from Madagascar, who would be willing to include insect flour in their products and cooperate for nutritional and sensory tests.

In parallel to the trials the two researchers in Madagascar together with the coordinating team (Dr. Narilala Randrianarison and Dr. Hery Andriamazaoro) conducted a household survey with 250 households that investigated consumption practices and willingness/interest in insect rearing and identification of favoured species.

In Myanmar, in the first quarter of 2019, the identification of suitable cricket species was conducted by Dr. Aye Aye Myint from Yezin Agricultural University (YAU). In addition, at YAU possible improvements of existing insect rearing methods to develop sustainable, time and energy saving and cost-efficient rearing methods for high quality insect protein was conducted in all of 2019. In the laboratories of YAU, Dr. Aye Aye Myint conducted trials with the favoured giant cricket (*Brachytrupes portentosus*), that has a long life cycle which is unfavourable for rearing. The species can still be considered interesting because of its high market value and strong consumer preference. She conducted feeding trials with different compositions of vegetables and protein sources and tried to overcome the challenge of reproduction under rearing conditions. The few experiences from Thailand showed the need to develop systems of semi-domestication, which are planned to be a next step in 2020. In Kengtung, after the cricket training courses given by the project collaborator Dr. Chama Phankaew from Kasetsart University (Bangkok, Thailand), the farmers in Kengtung township together with a ProciNut field assistant found out that the test-reared two-spotted cricket (*Gryllus bimaculatus*) can survive through winter season in Kengtung (8-33°C; min.-max), if the villagers moved the cricket rearing boxes into the sun light for warming every morning and returned the boxes to a protected place inside a house in the evening. Spectrum in cooperation with Yangon University initiated feeding trials for fish with black soldier fly larvae.



Seite 5 von 10

Nathan Preteseille, a doctoral student working on processing of insects tested four different drying techniques during 2019 (Roaster, Fluidized Bed Dryer, Oven, Sun Dryer) and compared different techniques targeting economic and energetic parameters and planned to assess in a next step nutritional, sensorial, safety and storability impacts. Results showed a suitability confirmation for drying applications of all four drying processes. For the roaster and oven, the drying conditions were optimal regarding efficiency/energy compared to the other techniques. After June 2019 the doctoral student paused and did not continue the research work. The research on processing was then continued by a research assistant from Mahidol University after October 2019. Based on Nathan Preteseille's long-year expertise in the insect sector, he shifted to another PhD topic that fit well into the research framework of ProciNut; DNA barcoding and pathology in cricket production systems in Thailand. The reasons for the relevance of this topic are that traceability and pathology research and good practice development in the cricket as food industry is clearly needed in the current context of limited data availability. The sustainability of the industry may be strongly impacted without proper monitoring of these aspects. Thailand produces a diversity of cricket species, collected from the wild and produced in farms. Traceability practices are very minimally implemented in the industry. Pathologies are reported to occur in some productions This represents a serious threat against industry growth and sustainability. A protocol and preliminary sampling were carried out, proving the methodology relevance for possible future implementation. Due to opposition against his research topic, that was expressed through social media, Nathan Preteseille decided to stop his research activities, apparently the research insights were not supported by government and private sector due to the fear that results might harm the image of the insect sector in Thailand, which in reality could have benefitted and used the knowledge to get prepared for the European Market, which the government is targeting.

**WP3:** In Madagascar two awareness events on national and regional level were conducted in August 2019. The national event took place in Antananarivo with 40 participants, including policy stakeholders from the agricultural ministry and ONN (Office National de Nutrition), and other public and private sector players. The regional event with 30 stakeholders was organized in Ambositra town with the participation of the "chef de la region", the regional office of ONN, the agriculture department, representatives of the sericulture training center, etc. The events were used to introduce the ProciNut project, its objective and approach to stakeholders. In Antananarivo a presentation was held by the University of Antananarivo on the potential of edible insects for Madagascar and in Ambositra an introduction was given by the regional office of ONN, showing the nutritional potential of insects for the region. The other ProciNut inputs (e.g. by NGN or icipe, see below) included knowledge on insect production from Eastern Africa, Nigeria and the Netherlands, information on food safety and general information on business models, value chain establishment, regulation etc. In Antananarivo in addition one presentation was held by an employee of Valala farms, which is the first certified cricket farm in the country and a close cooperation was attempted to exchange knowledge and material. After the policy events, one farmer training was conducted by Marian Peters from NGN (New Generation Nutrition) from the Netherlands on black soldier fly rearing that dealt with life cycle of insects, substrate preparation and general rearing techniques. And one farmer training was conducted on cricket production by Dr. Chrysantus Tanga from icipe in Kenya. Both training courses took place in the training facilities of the sericulture association in Sandrandahy and farmers showed great interest in both species and their production. The policy events were organized by the ProciNut coordinators, Dr. Nariala Randrianarison and Dr. Hery Andriamazaoro. The training courses and events were strongly supported by the two doctoral students Mr. Christian Ratompoarison and Mr. Andrianantenaina Razafindrakotomamonjy.

In Myanmar, an area assessment and a group meeting for cricket rearing training in three villages preceded a first cricket rearing training in June that was conducted by Dr. Chama Phankaew (project collaborator from Kasetsart University, in Bangkok, Thailand) within the Kengtung Township and supported by Dr. Pyae Pyae Thein, Ms. Myint Thu Thu Aung, Ms. Isabelle Hirsch and Dr. Jochen Dürr. Beforehand, a policy event was organized with the help of GIZ, with which a close cooperation is evolving. 45 local stakeholders and extensionists from the



Seite 6 von 10

health and agricultural ministries, Kengtung University and other interested NGOs were invited to raise awareness on edible insects and ProciNut. The actual training was conducted with farmers, especially women, who formerly expressed interest in insect rearing, the training covered the insect life cycle, management and design of housing (hands-on practice). A follow up of the training courses was organized and a field assistant (Sai Aung Myint Htwe) employed who accompanied farmers through the life cycle and communicated with the ProciNut team. In October, a follow-up training was given by Dr. Chama Phankaew and Dr. Aye Aye Myint to address challenges and opportunities of cricket rearing and to exchange experiences of the farmers and university staff, who decided to also set up cricket rearing trials.

Spectrum established a promising connection to authorities in Kayin state who are interested in promoting insect production. They expressed strong interest in possible training courses in the state, where cricket production is gradually coming up and would support ProciNut in awareness raising and conducting the household survey in 2020.

**WP4:** All members of ProciNut participated in the Tropentag conference in Kassel and presented their work and Dr. Jochen Dürr, Dr. Sarah Nischalke and David Allan/Pyae Pyae Thein presented their research work at the INSECTA conference in Potsdam. As part of the yearly meeting all doctoral students received a two day course in scientific writing and participated in a training on farmer participation and gender sensitivity in research and project work conducted by an external expert from the University of Hohenheim.

The yearly ProciNut meeting in September was held in Bonn to discuss achievements of all partners in regard to every work package and planning for upcoming activities in 2020. The workshop also included an excursion to our external partner NGN in the Netherlands to get an insight into a cricket production facility in the Netherlands and to get to know the partners and premises of NGN.

Regular communication via online meetings, phone/skype, and email is organized by Dr. Simone Kathrin Kriesemer to discuss and evaluate the progress of the project, administrative issues and to plan follow up steps.

#### Key statements:

- General:
  - The edible insect sector across the globe is extremely sensitive regarding competition. Therefore proactive cooperation and sharing along with ethical and transparent research practices are essential for knowledge sharing and working together
  - There is no automatism that consuming and collecting insects means that people are interested in rearing insects; awareness-building is essential, so that people understand the possibility and potential of insect production
  - There is a tendency of national insect sectors to either tilt more towards sustainability (focus on social and ecological aspects) or to tilt more towards a self-sustaining system (focus on economic issues), a functioning insect sector needs to embrace both aspects equally
- Madagascar
  - Farmers, extensionists and policy makers are very interested and open to the idea of insect rearing, so therefore there is a conducive policy environment and stakeholders also initiate activities themselves (e.g. round table to continue discussion on way forward)
  - The conditions for a self-sustaining insect sector are weak because most farmers/small entrepreneurs in need have such little financial means and labour capacities that they cannot even invest in simple feeds/housing structures for insects (plastic boxes)



Seite 7 von 10

- Value chains are very localized and short
- Interest was expressed by food processors (bakery and producers of caca pigeon snack) to test/use processed insects (powder) in their food products
  
- Myanmar:
  - States bordering Thailand remain the most important access point for ProciNut activities because they have had sufficient exposure and insect consumption goes far beyond the species of giant crickets.
  - There are first positive signs of policy support on state level, in Kayin state, where the Burmese president visited a cricket farm; the state government is interested in cooperating with ProciNut, inviting our activities on state level and supporting us to promote insects on national level
  - More and more (still fragmented) research activities are popping up at different universities across the country, initiated by ProciNut, LIFT and also self-initiated (insects for fish feed, testing to rear palm weevil, dung beetle and others).
  
- Thailand
  - Thailand has a well-established insect sector with a strong focus on a self-sustaining system, which is now threatened by a saturation of the (cricket) market and which needs further diversification towards other insect species
  - The sector has a strong economic perspective and fears competition from Myanmar, so that the South-South exchange needs government support and well-thought out strategies how knowledge could be transferred without harming the industry in Thailand
  - The opposition against one PhD topic of pathology/barcoding showed the risk of foreigners conducting research abroad and reveals a fear regarding the good image of the Thai insect sector, they do not want research that might reveal unfavourable facts about disease management and pathogens in insects, which would be useful in preparing for the EU market.

**Policy Advice:**

It is not only important to raise awareness about the opportunities and advantages of insect consumption and, even more, the benefits of insect production for food security and economic potentials. It is essential to treat the sector with great care, create trust and keep in mind the sensitivity, be it felt or real, of the sector, while seeking cooperation, initiating knowledge exchange, training visits and the big ProciNut excursion. This makes government involvement even more central in the design stage and hosting our activities can be a favourable option. The fact that the value chains are partly underdeveloped and looking at the challenges of going from collection/consumption to production/marketing shows the strong need to consider different economic challenges (finding pioneers, who are capable and willing to invest some money, having well thought out business models in place, establishing contracts with farmers and connections to processors, financial institutions etc.). It is also helpful to learn from other projects' experience (e.g. Flying food) who tried to experiment with contracts and materials for farmers who conduct trials, with establishing a division of labour (splitting production and reproduction) to prevent disease or the finding that working with different species within one family is a good way of spreading risk. In addition, considerations of social/cultural constraints (ethical dimension of killing insects in Myanmar, witchcraft associated with innovation in Kenya etc.) and resource constraints (problems of sourcing insect material, eggs, local insect species) will increase technology adoption and sustainability of project outcomes.



*Picture 1: Insect tasting at policy event in Antananarivo, Madagascar (Isabelle Hirsch)*



*Picture 2: Enumerator conducting an interview in the Sandrandahy Region of Madagascar (Sebastian Forneck)*



*Picture 3: Wild harvesting of bamboo worms near Kengtung (Ingo Wagler)*





Seite 9 von 10



Picture 4: Laboratory insect trials, University of Antananarivo, Madagascar (Andrianantenaina Razafindrakotomamonjy)



Picture 5: Substrate preparation during training of black soldier fly in Sandrandahy, Madagascar (Sarah Nischalke)



Picture 6: Cricket rearing training (desing of housing) in Kengtung township, Myanmar (Jochen Dürr)