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An overview of inVALUABLE: Insect Value Chain in a Circular Bioeconomy

70th EAAP, 26-30 Aug 2019

Lars-Henrik Lau Heckmann, Head of Section, PhD

70th EAAP Meeting, Ghent 2019

inVALUABLE

Project session on inVALUABLE (sessions 58+69)

- 12 project presentations by consortium partners
- 1 external presentation by Dr Jonas House, Wageningen University

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Main challenges of the (Danish) insect industry

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- **Upscaling (industrial level)**
  - Insect biology in production environment
  - Development of (customized) automation
  - Development of species-specific feed
- **Legal barriers (EU) in feed and food**
  - Increasing the knowledge-level on feed/food safety of insects
  - Political priority to promote the use of insects as feed and food
- **Consumer acceptance**
  - Information...

Danish public R&D projects 2018/19 (>100k €)

DTI lead highlighted in bold

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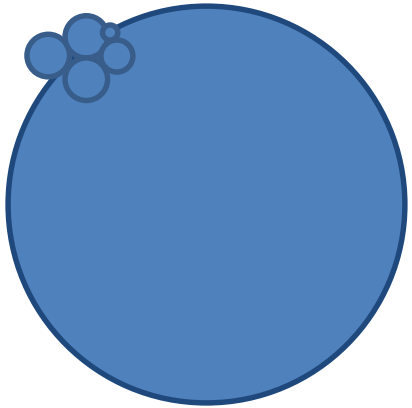
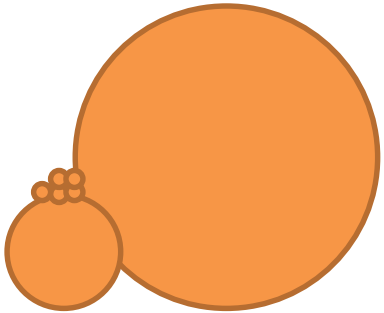


Black Soldier Fly (BSF)

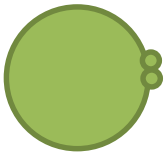
- **WICE (390k €, MUDP)**
- SUPERIOR (375k €, MUDP)
- Green Biorefining (360k €, F&I)
- BIOFISK (~100k €, Interreg/EU)
- WICE4SOIL (~260k €, MUDP)
- ENORM (~100k €, IFD)
- VARGI (~8.7M €, MUDP)
- Small2Big (~100k €, F&I)



Mealworms

- **inVALUABLE (3.7M €, IFD)**
- **SUSMEAL (1.1M €, IFD, Eurostars)**
- Consibio (~100k €, IFD)
- Wholi Foods (~100k €, IFD)
- ENORM (~100k €, IFD)
- NLF (135k €, IFD)
- Ikadan (135k €, IFD)

>16M € portfolio



Crickets

- InUrban (~600k €, GUDP)
- Syngja (200k €, IFD)
- Synjga2 (185 €, FFI)

inVALUABLE: Overview

Insect Value Chain in a Circular Bioeconomy

inVALUABLE

Duration: 2017-2019 (36 months)

Total budget: 3.7M EUR (2.5M EUR investment from Innovation Fund Denmark)

The vision of inVALUABLE is to **create a sustainable resource-efficient industry for animal production** based on insects (focus on *T. molitor*)

The partners span the entire value chain and include entrepreneurs, experts in biology, biotech, automation, processing and food technology and safety. This **interaction of competences is key to lifting insect production to an industrial level**

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AUSUM 1778 GAARD 1901

DryingMate A/S

DTU Food
National Food Institute

novozymes

Hannemann Engineering

AARHUS UNIVERSITY

ScrapTrans Food to feed

Agrokorn passion for feed

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inVALUABLE: Focal areas

Insect Value Chain in a Circular Bioeconomy

inVALUABLE

Project Management (WP9)

Production

- WP1: Optimization of production (reproduction, production environment, pilot)
- WP2: Nutrition and Health (mealworm diet and diseases)
- WP3: Automation of production (robotics – handling, vision)

Processing

- WP4: Development of processing (treatment of substrates and insect biomass)
- WP5: Feed/Food safety (safety assessment, legislative advocacy)

Product Application

- WP6: Feed assessment (animal feed trials; nutritional and health)
- WP7: Food assessment (insect-based food and functional food ingredients)
- WP8: Influencing the market (dissemination; consumer acceptance)

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inVALUABLE: Production

Insect Value Chain in a Circular Bioeconomy

- **Optimizing production conditions** regarding reproduction, temperature/RH, larvae density and nutrition
- Establishment of **pilot test facilities** at DTI and pilot production at Ausumgaard
- Assessment of **mealworm diseases** and mitigation through probiotic treatment (University of Copenhagen)
- Test and implementation of **automation prototypes**

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inVALUABLE: Processing (and safety)

Insect Value Chain in a Circular Bioeconomy

- **Assessment of different processing methods for pre-treating mealworms** including freeze-, industry- and vacuum-drying, enzymatic treatment, hydrolysis, extruding and defatting (used in rat protein digestibility study)
- **Hazard characterization of relevant substrates** (Technical University of Denmark)
- Frequent engagement with national authorities and trade association to ensure dialogue and progress
  - 'Regulatory win' end of 2017 with **food registration of insect production**; effort coordinated with Danish Agriculture & Food and Danish Veterinary and Food Administration (DVFA)

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inVALUABLE: Product Application (Feed)

Insect Value Chain in a Circular Bioeconomy

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Assessing the nutritional and health value of mealworms and other insects by the use of state-of-the-art **animal models** (Aarhus University and University of Copenhagen)

- PDCAAS rat study analyzing **bioavailability and digestibility of mealworm protein after different pre-treatments processing methods**
- Two pigs studies: 1) DIAAS protein digestibility study **assessing five different species of insects** (lesser and common mealworm, banded and house cricket and BSF) **for animal and human nutrition**; and 2) **animal performance and health study** on mealworms and BSF including evaluation of **effects on immune and antimicrobial effect**
- Assessment of growth performance in broiler chickens on mealworms and BSF

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inVALUABLE: Product Application (Food)

Insect Value Chain in a Circular Bioeconomy

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- **Assessment of the human nutritional value of selected insects** (e.g. mealworms and crickets) using the DIAAS (Digestible Indispensable Amino Acid Score protein) method

- **Food application testing** with different types of treated (e.g. defatted or texturized) mealworm-meal products in selected products and recipes; supplemented by **sensory assessment and screening of functional properties** of the insect-meal

- **Product development**, e.g. during the MSc-course 'Thematic course in Food Innovation and Health at University of Copenhagen and with external collaborators

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inVALUABLE: Influencing the market

Insect Value Chain in a Circular Bioeconomy

- Strong collaboration with e.g. **Municipality of Copenhagen** on mutual events (e.g. Copenhagen Bug Fest)
- Consolidation of stakeholder network in collaboration with **Danish Insect Network (DIN)** >200 members since Nov 2016
- **Monitoring consumer acceptance** of different types of insect food products and assessment of public awareness of insects as food

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inVALUABLE: Stakeholder consolidation

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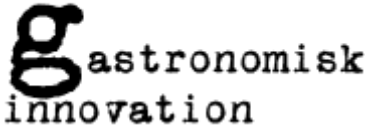

inVALUABLE: 'Spreading the word'

Insect Value Chain in a Circular Bioeconomy

- Strong focus on disseminating insects as feed and food to the public. Consortia participation in >**15 large national events** where there the project, and the notion of eating insects, has been **showcased to thousands of people**

- inVALUABLE has been **presented >50 times at national and international B2B events**

- Massive coverage in national and international media (>100 newsfeeds online, TV and radio since kick-off)

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inVALUABLE: Peer-reviewed publications

Insect Value Chain in a Circular Bioeconomy

- Jensen LD, Miklos R, Dalsgaard TK, Heckmann LH, Nørgaard JV (in press). Nutritional evaluation in rats of common (*Tenebrio molitor*) and lesser (*Alphitobius diaperinus*) mealworm and effect of processing of the lesser mealworm. Journal of Insects for Food and Feed.
- Heckmann LH, (2019). A case report on inVALUABLE: Insect Value Chain in a Circular Bioeconomy. J Insect Food Feed 5:9-13.
- Vangsoe M, Thogersen R, Bertram HC, Heckmann LH, Hansen M (2018). Ingestion of Insect Protein Isolate Enhances Blood Amino Acid Concentrations Similar to Soy Protein in A Human Trial. Nutrients 10: 1357.
- Vangsoe M, Joergensen MS, Heckmann LH, Hansen M (2018). Effects of insect protein supplementation during resistance training on changes in muscle mass and strength in young men. Nutrients 10: 335.
- Veldkamp, T, Eilenberg J (2018). Insects in European feed and food chains. Journal of Insects as Food and Feed 4: 143-145.
- Eilenberg J, van Oers MM, Jensen AB, Lecocq A, Maciel-Vergara G, Santacoloma LPA, van Loon JJA, Hesketh H (2018). Towards a coordination of European activities to diagnose and manage insect diseases in production facilities. Journal of Insects as Food and Feed 4: 157-166.
- Lecocq A, Jensen AB, Eilenberg J (2018). Diseases of insects in European production systems: Diagnosis, prevention and management. Berl Münch Tierärztl Wochenschr. DOI 10.2376/0005-9366-18061: 1-6.

Project collaborations

inVALUABLE

Student collaborations

To date, a total of **3 PhD, 10 MSc and 21 undergraduate projects** have been undertaken in collaboration with inVALUABLE partners

Public and private external collaborations

To date, a total of **12 external collaborations** have been undertaken with private (7) and public partners (5) and inVALUABLE partners

COPENHAGEN BUGFEST

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THANK YOU FOR YOUR ATTENTION!

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