

DANISH TECHNOLOGICAL INSTITUTE

Opportunities and challenges of producing insects at industrial scale

Circular Bioeconomy Days 2019

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Insects have 'tailwind'... but still some distance to go



Main challenges of the insect industry

Upscaling (industrial level)

- Insect biology in production environment
- Development of (customized) automation
- Development of species- and life-stage 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/food

Consumer acceptance (mainly as food)

Information...



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Upscaling: EU volume forecast



Estimated volumes of insect protein in Europe (kilo tonnes/year)

IPIFF vision paper 2018

Upscaling: Top performers

Species	Development time (egg-adult)	Macro-nutrition (%DM)	FCR*	Protein yield t/ha/yr and t/m3/yr	Current EU production level (t ww/yr)	Expected sales price (€ t/DM)	Main markets
Tenebrio molitor (Common mealworm)	60-70 days	Protein: 45-55 Fat: 20-35	4-6	ha: ca. 100 m³: ca. 0.1	1,000-5,000	3,300- 13,500	Food Pet food
Alphitobius diaperinus (Lesser mealworm)	40-50 days	Protein: 50-60 Fat: 20-30	3-5	ha: ca. 200 m³: ca. 0.2	1,000	3,300- 13,500	Food Pet food
Hermetia illucens (Black soldier fly)	20-25 days	Protein: 35-45 Fat: 15-35	2-3	ha: >600 m³: ca. 0.4	1,000-5,000	1,300-3,300	Feed Pet food

Fischer et al., 2019

*Feed Conversion Rate based on dry matter conversion

Upscaling: Heat... a 'double-edged sword'

Insects are cold-blooded (poikilotherm) animals, but still emitting ~15W/m²

Combining biological data with CFD modelling to simulate key parameters @ large-scale



R&D in Denmark 2018/2019 (>100k €)



Black Soldier Fly (BSF)

- <u>WICE</u> (390k €, MUDP)
- SUPERIOR (375k €, MUDP)
- Green Biorefining (360k €, F&I)
- BIOCAS (~100k €, Interreg/EU)
- WICE4SOIL (~260k €, MUDP)
- ENORM (~100k €, IFD)
- ENORM BioFactory (~8.7M €, MUDP)

>16M € portfolio

Crickets

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



Mealworms

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

EU Legislation – feed (generic)

Feedstocks

- V Plant-based substrates
- Unprocessed former foodstuff: dairy and eggs
- X Unprocessed former foodstuff: meat and fish 3
- Catering waste and slaughterhouse products (3)
- 关 Animal manure



Seven species defined by EU as farmed animals for feed use

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Currently legal US/CA – EU expected in 2019

Currently not legal EU or US/CA – EU expected in 2020⁺

EU Legislation - food

European Commission > Food, farming, fisheries > Food Safety > Food > Novel food > Authorisations >

Food

NOVEL FOOD

Legislation

Authorisation procedures

Union list of novel foods List of authorisations under the old novel food regulation Consultation process Novel food catalogue e-submission ALL TOPICS Overview of ongoing NF applications Summary of ongoing applications and notifications

Summary of the ongoing applications

In accordance with the requirements laid down in the Novel Food regulation, the European Commission will make the summary of the application publicly available based on the information concerning the name and address of the applicant, the name and description of the novel food and scientific evidence demonstrating that the novel food does not pose a safety risk to human health.

List of the summaries of the ongoing applications:

- Acheta domesticus (house cricket)
 Allanblackia seed oil
- Allandiackia
 Allulose
- Allulose Allulose
 Apoaequorin Allulose
- Whole and ground Alphitobius diaperinus (lesser mealworm) larvae products
 - Bacterial cellulose
 ¹/₂
 - Beta-Hydroxybutyrate salts
 Chia seeds in chocolate
 - Chia seeds in chocolate
 Chia seeds in fruit spreads
 - Egg membrane
 *
 - Embryonated eggs of the whipworm *Trichuris suis* 🔑
 - EPA-rich oil from Phaeodactylum tricornutum
 - Eurycoma longifolia (Tongkat ali) root extract ^{Max}
 Mixture of 2'-Fucosyllactose and Difucosyllactose ^{Max}

 - Hovenia dulcis fruit extract
 - Inulin-Propionate Ester 🔑
 - 🔹 Isomalto-oligosaccharides 🔑
 - Isomaltulose syrup (dried)
 - Lactitol 🔑
 - Lacto-N-tetraose
 ¹/₂*
 - Migratory locust (Locusta migratoria)
 - Heat-killed Mycobacterium manresensis
 ^N
 - Nicotinamide riboside (NR) 🎤
 - Olive leaf extract

Novel Food applications on insects

Common mealworm Lesser mealworm Black soldier fly Honey bee House cricket Banded cricket Migratory locust



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IPIFF Novel Food Guidelines

Thank you for your attention



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