KICK OFF WORKSHOP OM DANSK INSEKTINDUSTRI

TID OG STED

21. marts kl. 9.30-16 (registrering og let forplejning 9.30-10)
Axelborg, Axeltorv 3 - 1609 København V.

KØBENHAVNS UNIVERSITET
DET NATUR- OG BIOVIDENSKABELIGE FAKULTET

TEKNOLOGISK INSTITUT

Danmarks Tekniske Universitet DTU

Miljø- og Fødevareministeren

PROGRAM/WORKSHOP

PROGRAM

Dagens oplæg byder på inspiration og perspektivering fra en række danske og internationale nøglepersoner, som tilsammen vil tegne et billede at mulighederne for insektindustrien. I eftermiddagens workshops vil relevante eksperter sikre, at alle får et godt indblik i hvad man allerede kan og må, hvor udfordringerne i udviklingen ligger og afklare hvad der skal til, for at vi kan kick starte en dansk insektindustri.

Ann Marker, videnskabsformidler, faciliterer dagen og sikrer, at der bliver god plads til dialog undervejs.

Karen Hækkerup, Adm. Direktør, Landbrug og Fødevarer byder velkommen. Derudover vil der være oplæg fra flg.:

- *"Why is insect production relevant and a good business case?"* by **Glen Courtright** (US), founder of EnviroFlight, LLC.

- *"Status and potential for a Danish insect industry"* by **Lars Lau Heckmann**, Scientific Project Manager InVALUABLE, Teknologisk Institut

- *"Success and challenges for Proti-Farm, and framework conditions in the EU and outside the EU"* by H**eidi de Bruin**, CEO, Proti-Farm and Vice President in IPIFF (The International Platform of Insects for Food and Feed)

- *"EU's vision for insect production for feed and food"* by **Wolfgang Trunk**, policy officer at DG SANCO, European Commission

WORKSHOP OM FØLGENDE 4 EMNER

Insektproduktion som en del af cirkulær økonomi – ledes af afdelingschef Dorte Lau Baggesen (DTU) og PhD studerende Afton Halloran (KU).
Fokus på substrater, recirkulering, restproduktets næringsværdi som gødning og risikovurderinger.

Primærproduktion – ledes af faglig leder Lars Lau Heckmann (TI) og lektor Annette Bruun Jensen (KU).
Fokus på automatisering, opskalering, match af insekter og substrater, insektsundhed i produktionen.

Forarbejdning af insekter – ledes af konsulent Christian Holst Fischer (TI) og senior forsker Annette Nygaard Jensen (DTU).
Fokus på forarbejdningsteknologier, håndtering af foder- og fødevaresikkerhedsmæssige risici, dokumentation og egenkontrol.

Insektbaserede produkter – ledes af lektor Nanna Roos (KU) og sektionsleder Anne Louise Dannesboe Nielsen (TI).
Fokus på produkttyper, ernæringsværdi, fødevarer, foder, forbrugerinteresser, tilgængelighed.

I alle workshops deltager relevante fagkompetencer fra Miljø- og Fødevareministeriet.

Workshop-sessionen afsluttes i plenum med fokus på hvordan vi kommer videre herfra.

16.00 – farvel og tak

REQUIREMENTS FOR FEEDING FARMED INSECTS AND THE USE OF INSECTS AS FEED AND FOOD IN DENMARK

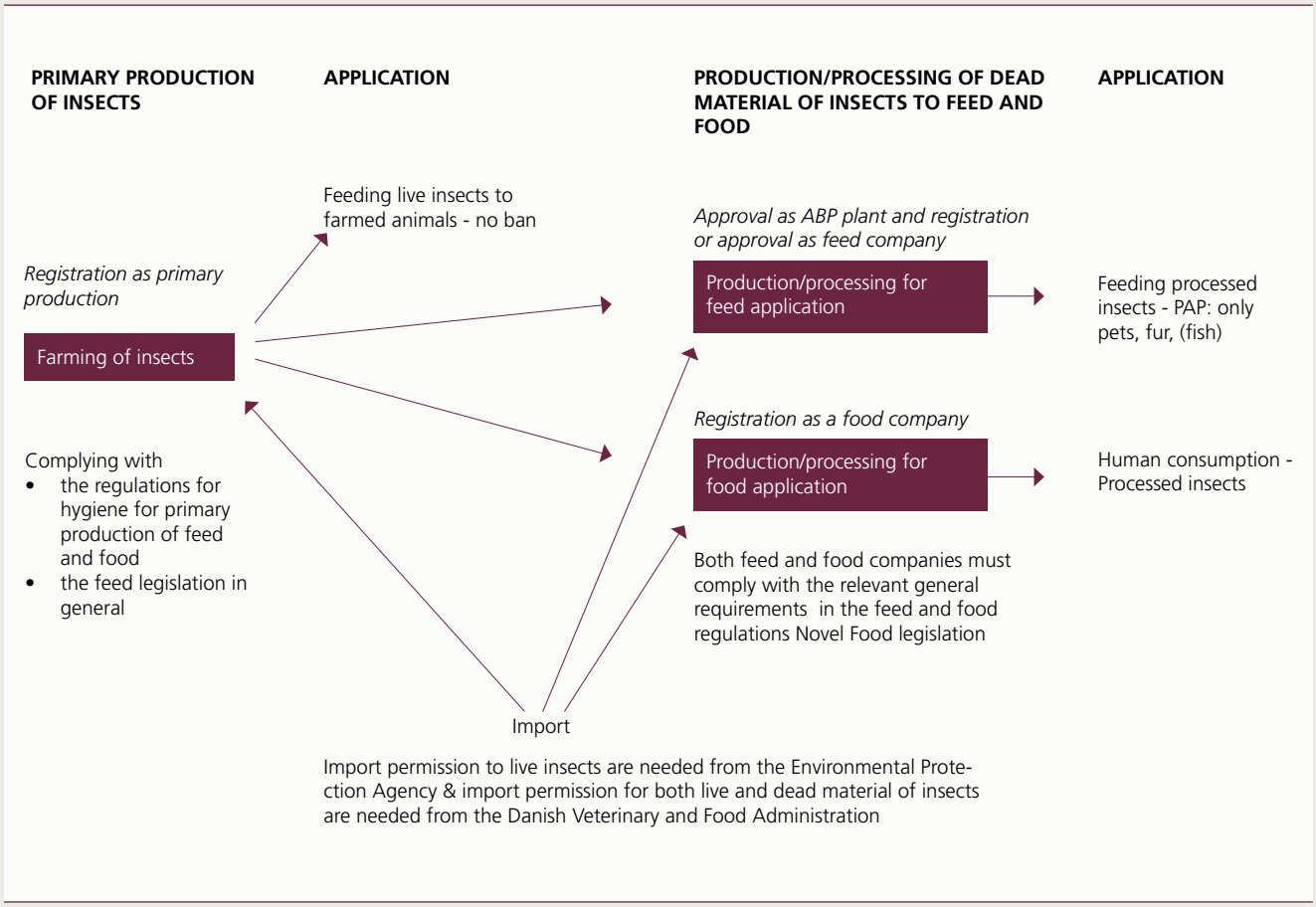
Production and use of insects for feed and food is an up and coming industry in Denmark. Therefore, the Danish Veterinary and Food Administration (DVFA) has published a guidance regarding insects.

The guidance describes the different legislation in the specific context of farming insects for feed or food, and the guidance provides links to relevant homepages and the original legislative text.

LEGISLATION

In general, the farming and production of insects for feed and food is comparable to other kinds of farming and production of feed and food of animal origin. Therefore, the legislative framework for insects is similar to legislation for farmed animals and other relevant legislation for feed and food.

In each step of the production chain from farming to processing and selling of insects as feed or food, there are requirements for registration or approval according to relevant legislation. A simplified overview of the principle legislative framework is outlined in the figure below.



ABP: animal by-product
PAP: processed animal protein

By Dorte Lau Baggesen, Head of Division, Division of Microbiology and Production, DTU Food
Key reference: "Insekter – opdræt og brug som foder og fødevarer I Danmark og EU – hvad må man og hvad må man ikke?", DVFA guide

INSECTS AS A DRIVER OF THE CIRCULAR ECONOMY IN FOOD AND FEED PRODUCTION

THE CIRCULAR ECONOMY IN THE EUROPEAN UNION

The EU commission is working on an ambitious circular economy strategy intended to transform Europe into a more competitive resource-efficient economy. The motto of the EU strategy is 'Circular Economy: Boosting business, reducing waste'.

Until now, the Commission has adopted an ambitious Circular Economy Package, which includes revised legislative proposals on waste to stimulate Europe's transition towards a circular economy. The package consists of an EU Action Plan for the circular economy that establishes a specific and ambitious programme of action. It includes measures covering the whole cycle of products and a range of initiatives, with some of particular interest from an 'insect point of view':

- A common EU target for recycling 65% of municipal waste by 2030.
- Specific measures to promote re-use and stimulate industrial symbiosis - turning one industry's by-product into another industry's raw material.
- Economic incentives for producers to put greener products on the market and support recovery and recycling schemes.

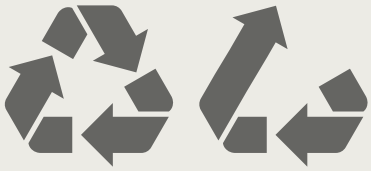
FAO'S STRATEGY FOR SUSTAINABLE FOOD PRODUCTION SYSTEMS

At the same time, the Food and Agriculture Organization of the United Nations (FAO) has a strategy to aid the development of sustainable food production systems that can deliver:

- A good source of protein.
- Low environmental impact.
- High output to meet future demands.

RE- AND UPCYCLING

The insect industry has great potential for implementing the FAO's strategy and the EU's strategy on circular economy by re- and upcycling by-products within the food and feed chain. However, the approach is not fully commercialized, and the true potential of the insect industry is thus not (yet) realized. Current business projections suggest insects as food will constitute an annual turnover of >2 billion DKK in Europe in 2020, with a similar projections for North America.



LIFTING THE INSECT INDUSTRY TO A COMPETITIVE LEVEL

National and international innovation initiatives, such as inVALUABLE (Insect Value Chain in a Circular Bioeconomy), aim to lift this novel industry to a competitive level. Insects can provide an efficient technology to convert by-products into feed and food; supporting both a circular economy as well as a resource- and climate-efficient approach to modern food production.

This is partly catalysed through the formidable 'biological flexibility' that many insects have regarding utilizing different organic resources as feed as well as their high efficiency regarding converting feed into food (insect biomass). There are numerous high-tonnage by-products available in Denmark and throughout Europe; e.g., brewery waste from beer production alone constitutes >200,000 t/yr in Denmark. However, the 'insect recycling-technology' is still young and future cost-effective insect production methods are dependent on a multi-disciplinary and concerted effort between research institutes, private enterprises and authorities.

As an internationally leading food innovation hub, Denmark has the opportunity to further strengthen its position and be among the 'first movers' setting the future agenda of this new industry, and thereby supporting sustainable food production for current and future generations.

By Lars Lau Heckmann, Technology Manager, Danish Technological Institute
Key reference: Edible Insects – Future prospects for food and feed security, FAO report 171, 2013

INSECT SPECIES WITH THE MOST POTENTIAL TO BE UTILIZED AS FOOD AND FEED IN THE EU

At least 2,000 different insect species have been identified as 'edible'. This means their consumption by humans has been recorded, but the number has probably been higher. The highest diversity of edible insects is found in Asia, followed by Africa and South America, while very few species have been found to be consumed in Europe.

In a European context, twelve insect species (Table 1) have been identified as having the most potential to be used as food and feed, according to the European Food Safety Authority (EFSA). What these species have in common is that their general biology and physiology have been well studied, and in addition they have been the subject of studies in order to develop efficient methods for large-scale production. This makes them easy to farm and to use for industrial purposes.

Table 1: Insect species with potential in the EU.

INSECT ORDER	SPECIES	COMMON NAME (IN DANISH)	LIFE-STAGES USED	UTILIZATION
Diptera (flies)				
	Musca domestica	Common housefly (Stueflue)	Larvae	Feed
	Hermetia illucens	Black soldier fly BSF ("Sort soldaterflue")	Larvae/prepupae	Feed
Coleoptera (beetles)				
	Tenebrio molitor	Mealworm (Melskrubbe, melorm)	Larvae	Feed/Food
	Zophobas atratus	Giant mealworm (Kæmpemelorm)	Larvae	Feed/Food
	Alphitobius diaperinus	Lesser mealworm (Hønseribille, lille melorm)	Larvae	Feed/Food
Lepidoptera (moths)				
	Galleria mellonella	Greater wax moth (Stor voksmøl)	Larvae	Food
	Achroia grisella	Lesser wax moth (Lille voksmøl)	Larvae	Food
	Bombyx mori	Silkworm (Silkesommerfugl)	Pupae	Food/Textiles
Orthoptera (crickets/grasshoppers/locusts)				
	Acheta domesticus	House cricket (Husfårekylling)	Adult	Food/Pet feed
	Gryllodes sigillatus	Banded cricket (Steppe fårekylling)	Adult	Food/Pet feed
	Locusta migratoria	Migratory locust (Alm. vandregræshoppe)	Adult	Food/Pet feed
	Schistocerca americana	American grasshopper (Amerikans græshoppe)	Adult	Food/Pet feed

TAILORED SOLUTIONS FOR SPECIES DIVERSITY

Using insects in industrial production requires a tailored system for each species due to their species-specific life cycles and their need for adapted environmental conditions (e.g., temperature, humidity, light, space requirements, etc.).

Rearing insects can therefore be compared to traditional animal husbandry, where the different species (pigs, poultry, cattle, etc.) also require in-depth knowledge and specific facilities.

For example: Crickets and grasshoppers (both immature nymphs and adults) feed on fresh plant material and need an additional water supply. Furthermore, crickets need places to hide in between (e.g., egg cartons) to simulate their natural environment, but their cages otherwise have to be kept dry. On the other hand, mealworm larvae live on a dry substrate with a mixed vegetable/grain diet and no hiding material. Fly larvae ('maggots') need a wet substrate to live in and feed from, like slurry.

By Associate Professor, Annette Bruun Jensen and Professor Jørgen Eilenberg, University of Copenhagen
Reference: EFSA Scientific Committee, 2015. Scientific Opinion on a risk profile related to production and consumption of insects as food and feed. EFSA Journal 2015;13 (10):4257, 60 pp. doi:10.2903/j.efsa.2015.4257

NUTRITIONAL COMPOSITION OF INSECTS FOR FOOD AND FEED

Different insect species with a potential of mass production are being utilized either at larvae, pupae or adult stage, depending on the insect species. What all species have in common is that the whole insect is utilized, with few exceptions, such as the removal of wings from grasshoppers. The nutritional composition of insects varies by species and the life-stage utilized. However, like that of other animal-source foods, such as meat and fish, the primary macronutrient composites are protein and fat.

Protein and fat: Insect larvae and pupae have higher contents of fat and proportionally less protein, compared to the species which are utilized in the adult stage like crickets, grasshoppers and locusts (Table 1). Larvae can be processed for separation of fat and protein prior to utilization. Also, the feeding substrate will impact the composition. The protein quality measured as amino acid composition is generally favorable. The protein digestibility is indicatively good but needs to be fully documented for each insect species. The fat quality in terms of fatty acid composition varies between species and the feeding history. Generally, insects can be a good source of polyunsaturated essential fatty acids (linoleic and linolenic acids).

Chitin: Insects are physiologically characterized by having a chitin exoskeleton. Chitin in diets is functionally regarded as dietary fibers; however, chitin may be digestible and have anti-inflammatory and other bioactive properties, which needs to be fully documented.

Micronutrients: Contents of minerals and vitamins are highly variable between species. Many species have been found to have high contents of particularly iron and zinc. However, bioavailability of minerals for humans and animals needs further assessment.

Allergens: Cases of allergic reaction caused by consumption of insects have been documented; for example, in cases where those suffering from crustacean allergy also react to insects. Documentation of allergic risks could potentially advise labelling of insect products in the future.

Table 1. Insect species currently produced in closed managed systems.

INSECT ORDER	COMMON NAME (IN DANISH)	LIFE-STAGES USED	PROTEIN (% dry matter)	FAT (% dry matter)
Orthoptera				
Crickets				
Acheta domesticus	House cricket (Husfårekylling)	Adult	60-75	7-20
Gryllodes sigillatus	Banded cricket (Steppe fårekylling)	Adult	60-75	7-20
Grasshoppers/locusts				
Locusta migratoria	Migratory locust (Alm. vandregræshoppe)	Adult	40-60	10-25
Schistocerca americana	American grasshopper (Amerikansk græshoppe)	Adult	40-60	10-25
Diptera (flies)				
Musca domestica	Common housefly (Stueflue)	Larvae	55-70	10-25
Hermetia illucens	Black soldier fly (Sort soldaterflue)	Larvae/prepupae	40-60	20-40
Coleoptera (beetles)				
Tenebrio molitor	Mealworm (Melskrubbe, melorm)	Larvae	45-55	25-35
Zophobas atratus	Giant mealworm (Kæmpemelorm)	Larvae	40-50	40-45
Alphitobus diaperinus	Lesser mealworm (Hønseribille, lille melorm)	Larvae	45-60	25-30
Lepidoptera (moths)				
Galleria mellonella	Greater wax moth (Stor voksmøl)	Larvae	35-45	40-60
Achroia grisella	Lesser wax moth (Lille voksmøl)	Larvae	35-45	40-60
Bombyx mori	Silkworm (Silkesommerfugl)	Larvea/pupae	50-70	8-10

There is limited information about the volumes of insects consumed worldwide due to a lack of statistical information on trade and production/wild harvest.

By Nanna Roos, Department of Nutrition, Exercise and Sports (NEXS), University of Copenhagen, Denmark
Key reference: Rumpold B.A. and Schlüter, O.K. (2013) Nutritional composition and safety aspects of edible insects. Mol. Nutr. Food Res., 57 (2013)