Policy Paper

Guidelines on insect research

October 2022

The growing interest on insect production practices has led to an exponential increase of publications in recent years. However, the lack of information provided in these publications often hamper comparison among them. it is now the time to ***implement guidelines and procedures on the practices of insect research****.*

Besides the need for standardization of insect rearing conditions, it is important to harmonize appropriate analytical methods to determine ***the nutritional value of insects and their feed****.*

1. ValuSect's input

ValuSect partners developed **a standardised protocol for mealworm feed experiments**. After the input from a work group bound to the EAAP congress, a more advanced protocol is being revised through the performance of a Ring test (Berrens, 2021).

A **protocol for insect feed experiments including experiments with yellow mealworm, house crickets and migratory locusts** including guidelines on proper sampling and suggestions on the analysis of frass, insects and their substrate is also being developed. After interpretation of the results and adaptation, it will soon be published and serve **as basis for guidelines on standardization of insect research**.

This policy brief aims at providing the essential information. A complete document can also be found here.

Due to the lack of **standardization on insect analysis for research purposes**, ValuSect's partners will publish a report that can serve as basis for insect analysis standardization for sampling and proximate analysis.

2. Suggestions of research guidelines

2.1. On insect production

The tables below summarize the minimal information we suggest should be mentioned in insect research.

Before experiment		
Parental population	**Egg harvest**	**Nursing phase**
Origin: • Company or location	Harvesting method used	Rearing conditions: • Temperature • Relative humidity • Day/night regime
Rearing conditions: • Temperature • Relative humidity • Day/night regime • Light source (if relevant)	Incubation • Temperature • Relative humidity • Day/night regime	Diet: • Origin • Ingredients • Pre-treatment • Storage conditions and duration • Proximate analysis with specification of techniques
Diet: • Origin • Ingredients • Pre-treatment • Storage conditions and duration • Proximate analysis with specification of the techniques		Rearing process: • Duration of nursing phase • Feeding regime • Population density
Rearing process: • Oviposition substrate • Density • Oviposition duration (spread on age eggs)		

During experiment		
Diets used	**Rearing conditions & process**	**Parameters**
Origin	Temperature	Conversion • Method • Calculation

Ingredients	Relative humidity	Growth • Method of subsampling • Growth curve
Pre-treatment • Method • Equipment	Day/night regime Light source (if relevant)	Mean individual end weight
Storage • Conditions • Duration	Amount of replicates	Total yield
Proximate analysis and analytical techniques used (if available)	Feeding regime	Insect proximate analysis and analytical techniques used
	Density	Insect survival rate

End of experiment
Harvesting time: • Duration of experiment • Method (i.e. fixed time, first pupae present, etc.) • Starving period (if applicable)
Harvesting • Method • Materials used (if relevant)
Insect sampling How insect samples are processed and stabilised for storage (freezing, grinding, vacuum pack, etc)

2.2. On insect analysis

Insect proximate analysis should include at least:
- crude protein content,
- fat content (or ether extract),
- dry matter content,
- crude ash,
- chitin content.

a) Sampling methodologies

The amount of insect sample should be determined. For this it should be known whether the analysis will be performed in duplicate, or ideally, in triplicate. We suggest an amount of at least 300 g fresh sample for analysis. 50 g of fresh sample will be used to determine the dry matter content. The remaining 250 g will be pretreated for further analysis.

Since some insects such as mealworms are cultivated in their substrate, it is important they are washed to **remove contaminations** such as frass and feed leftovers. The protocol applied to remove non-desired components needs to be harmonized (sieving, washing out, etc.).

b) Pre-treatment for analysis

Pretreatment can include one or several steps until the sample is ready to be analyzed.

1) **Insects need to be killed** before analysis can be performed. Techniques such as blanching or freezing can be used. The temperature and duration of the process must be mentioned.

2) **Insects need to be dried**. Techniques such as oven drying, microwave drying, freeze drying and others can be used. Temperature and time are also important parameters which need to be clarified (wattage must be mentioned for microwave drying and vacuum pressure for freeze drying need to be mentioned).

3) **Homogenization of the sample** is necessary to perform correct analysis. It is recommended that the samples are milled to obtain a powder with a regular particle size.

4) **A separation step** can be include depending on the further analysis of the insects (including filtering, pressing, enzymatic as isoelectric precipitation etc.)

c) Analysis practices

It is suggested to use **AOAC methods** since these are followed consistently for proximate analysis, fatty acid profile and amino acid profile. In case the AOAC methods are not followed, we recommend mentioning the following parameters for each specific:

Parameters
Dry matter and ash • Time and temperatures used
Crude protein content • Technique that was used (Kjeldahl, Dumas, Amino Acid Analysis, …) • Related factors to calculate results (e.g. N to P factor) • Sample preparation (sample volume for Kjeldahl/Dumas, hydrolysis protocol for Amino acids)
Crude fat content • Technique that was used (extraction, infrared, …) • Sample volume • Sample preparation (grinding, hydrolysis, …)
Chitin content • Technique that was used (manual extraction, fibre system, …) • Sample preparation (drying temperature, defatting, …)

d) N to P ratio

After evaluating the **amino acid profile** of *T. molitor*, *A. domesticus* and *L. migratoria*, it was observed that the right pure protein conversion factor (K_A) was of 5.75, 5.51 and 5.49 respectively; meanwhile the nitrogen-to-protein conversion factor (K_p) was of 5.41, 5.25 and 5.33. These authors recommend using an average value of 5.33 and 5.60 for Kp and K_A respectively.

A similar approach needs to be taken when analyzing the protein content in the substrate.

e) Digestibility

Since **digestibility is becoming a very important factor** for insect-based products, it might have to be considered to include this in the standard analysis. It is suggested to follow the methodology described by Brodkorb et al. (2019). This *in vitro* protocol was revised and updated by a multidisciplinary team, aiming to provide a standard protocol.

3. Conclusions

There is a **need for standardisation of insect research** to compare data and harmonise research, which can be further transferred to industries and stakeholders.

It becomes even **more urgent** as insect research has gained a lot of interest lately.

We invite all to use the suggestions presented in this document and to read more about it in our full document available *here*.

What is ValuSect?

ValuSect is a project funded by Interreg North-West Europe. The ValuSect consortium will improve the sustainable production and processing techniques of insect-based products and transfer developed knowledge to agri-food businesses in North-West Europe.

Since March 2021, the project extended its focus to the insect feed sector.

Associated partners

Belgian Insect Industry Federation www.biif.org
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