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Microbiological analyses of food insect products

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Introduction

So far only the criteria for *Listeria monocytogenes* of the Microbiological Criteria Regulation (EC) No 2073/2005 can be applied to food insect products. Further microbiological criteria have not yet been established. In order to find out whether other germs could also pose a risk to consumers, food insect products were examined for possible pathogenic and hygiene-related bacteria at the Chemical and Veterinary Investigation Office (CVUA) in Freiburg. The aim is to create a basis for the establishment of new investigation parameters.

Materials and Methods

In 2019, 36 food insect products have been investigated at the CVUA Freiburg (to date August 30th). The analysis of the edible insect products is based on the parameters listed in Table 1 and Table 2. These microbiological parameters were established on the basis of test results obtained in insects. They represent only a recommendation for official monitoring according to the current state of knowledge.

Table 1: Parameters as orientation values for assessing the hygiene of the products (in cfu/g)

Parameter	Product	Limit	Method
Aerobic colony count	Boiled and/or fried whole insects	10^4	DIN EN ISO 4833-2: 2014-05
	Other insect products	10^6	
Bacillus cereus	All insect products	10^3	ASU L 00.00-33: 2006-12
Coagulase-positive Staphylococcus	All insect products	10^3	DIN EN ISO 6888-2: 2003-12
Escherichia coli	All insect products	10^1	ASU 00.00-132/2: 2010-09
Enterobacteriaceae	All insect products	10^3	ASU L06.00-24: 1987-11

Table 2: Limits for *Salmonella* spp. and *Listeria monocytogenes*

Parameter	Limit	Method
***Salmonella* spp.**	Absence in 25 g	DIN EN ISO 6579-1: 2017-07
Listeria monocytogenes	Regulation (EC) No 2073/2005 Annex I Chapter 1 Food category 1.1 to 1.3	DIN EN ISO 11290-1: 2005-01

(ASU = Official collection of investigative proceedings,
DIN = German Institute for Standardization,
EN = European Committee for Standardization,
ISO = International Organization for Standardization)

Results

- **Product groups:** whole animals, burgers, bars, granola, convenience food and pasta (Figure 1)

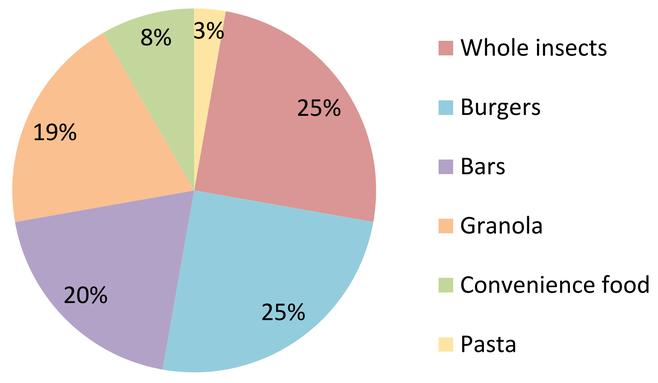

Figure 1: Investigated insect products (n=36) grouped by food category

- **Aerobic colony count:**
  from undetectable to 1,5 x 10^6 cfu/g (Figure 2)
- ***Bacillus cereus:***
  6/36 examined samples in a quantity that could not be determined (present, less than 400 cfu/g)
- ***Enterobacteriaceae*:**
  2/36 samples (all below 10^3 cfu/g)
- ***Listeria monocytogenes:***
  3/36 samples (all positive in enrichment, one sample also culturally positive in a quantity that could not be determined (present, less than 40 cfu/g))

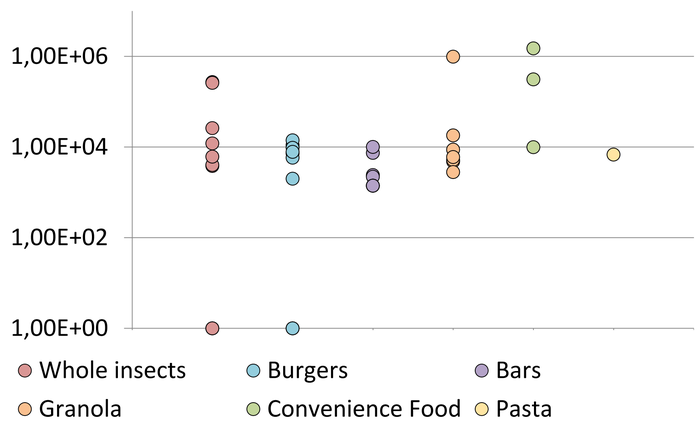

Figure 2: Aerobic colony count of the investigated insect products

All *Listeria monocytogenes* positive samples were insect burgers, which explicitly indicate the heating prior to consumption and therefore did not fall under the requirements from category 1.1 to 1.3 of Regulation (EC) No 2073/2005 (Table 2). Accordingly, these products did not pose a risk to consumers. Only one sample contained both *Enterobacteriaceae* and *Listeria monocytogenes.*

Discussion

Compared to the microbiological benchmarks and warning values for the assessment of foodstuffs of the German Society for Hygiene and Microbiology (DGHM), the values of the tested samples lie within comparable products without insect components. Only one insect-granola sample exhibited an aerobic colony count (9,8 x 10^5 cfu/g) above the recommended benchmark of 1 x 10^5 cfu/g for mueslis and flakes. In order to establish investigation parameters, some European countries have published national guidelines on food insects, which contain different recommendations for microbiological criteria (Table 3). Detailed information on the evaluation scheme can be found in the publication by Grabowski et. al. about the current legal situation of edible insects in Europe [1].

Table 3: Microbiological safety parameters [1]

Parameter	Austria	Belgium	Denmark	Finland
Aerobic colony count	+	+	+	+
Enterobacteriaceae	+			+
Escherichia coli	+	+		+
Staphylococcus aureus	+			+
Bacillus cereus	+			
***Bacillus cereus* group**				+
Clostridium perfringens	+			
Sulphite-reducing clostridia				+
***Salmonella* spp.**	+	+		+
***Campylobacter* spp.**	+	+		
Listeria monocytogens	+	+		+
Yeasts				+
Moulds				+

Conclusion

During the analysis at the CVUA Freiburg, pathogenic and hygiene-related bacteria (*Bacillus cereus, Listeria monocytogenes, Enterobacteriaceae*) were found in 10/36 food insect products. This demonstrates that food insects could pose a microbiological hazard and a monitoring is necessary. As a result, food law should be adapted to ensure the food safety of food insects.

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References:

1. Grabowski NT, Ahlfeld B, Lis KA et al. (2019) The current legal status of edible insects in Europe. Berl. Münch. Tierärztl. Wschr. 132: 295-311