



INSECTS IN AQUACULTURE MARKET



The European insect production sector today

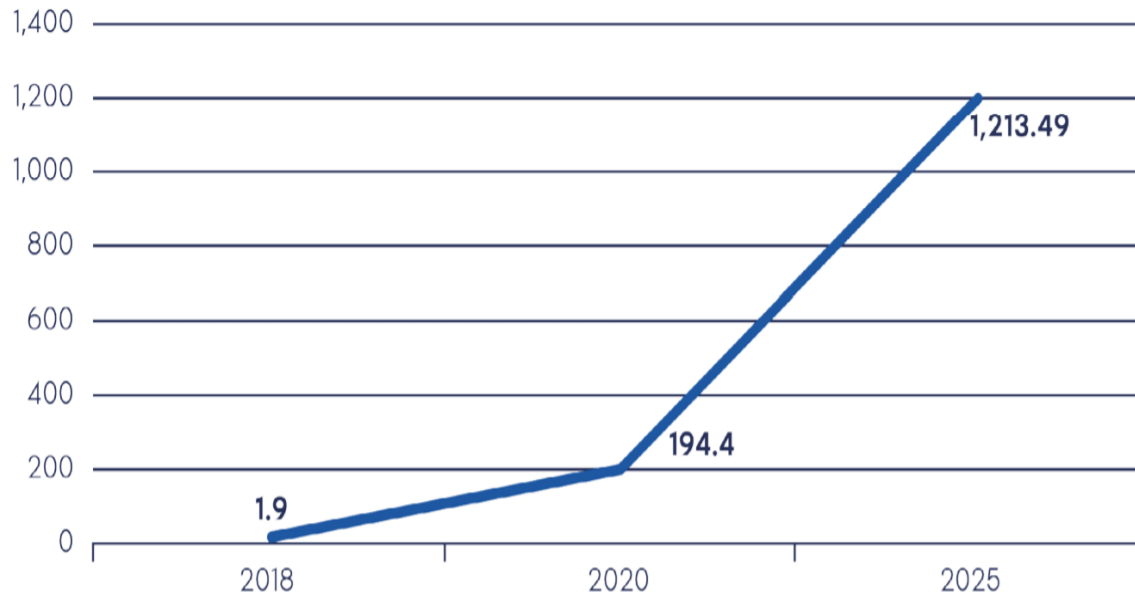
- Predominantly composed of **SMEs**, serving both the **food & feed** markets;
- European companies play a leading role in terms of **innovation** and **technological advancement**;
- EU production represents today few **thousands tonnes**, whereas investments account for more than **500 Million Euros** – 2 billion EUR are expected by 2025 (source: *IPIFF questionnaire October 2018*);
- **More than a thousand direct jobs today** – likely to exceed five thousands by mid 2020s.

Today insect farming is a European business reality



How will the insect sector develop?....

Estimated volumes of production of
insect protein until 2025 in Europe
(in thousands of tonnes)



Source: IPIFF questionnaire October 2018

According to preliminary estimations the European insect sector will generate:

- **Close to 3Mtn of insect protein (for food and feed) by 2030;**
- **Circa 10Mtn of insect frass, complementing the growing demand for fertilising products;**
- **More than 20 000 direct jobs.**

The potential of insects in aquaculture

- Insects represent up to 40% of the **natural diet** of trout species;
- **Protein levels** in insect meals vary between 55% and 75%;
- **High digestibility** levels: between 80% and 95% , depending of the insect specie
- Feed incorporation rates vary (from 5 % to 40% and more), depending on the **insect species**, the **growth stage** of the fish and their species-specific requirements.

'First successes': insect proteins in aquaculture

(authorised since 1st July 2017)

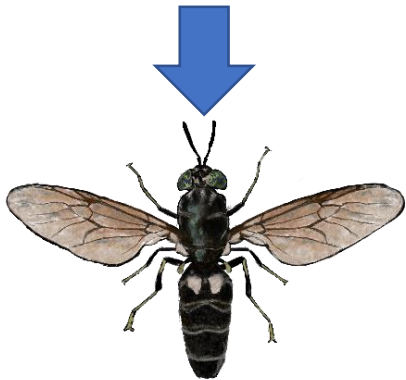


- The 'aqua feed authorisation (7 species authorised) constituted a **major 'milestone'** towards the development of the European insect production.
- **Several thousand tonnes** of insect protein have been commercialised by European insect producers since the aqua feed authorisation.
- **More than half** of companies produce insect protein for aquaculture feed.

Main used insect species in fish feed



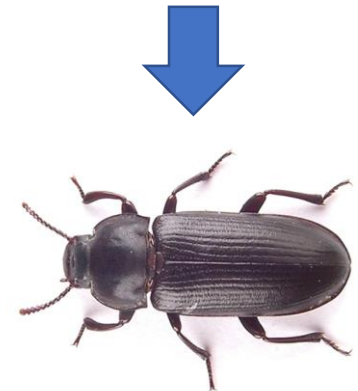
Hermetia illucens
Black Soldier Fly



BSF	DRY WEIGHT LARVAE CONTENTS	YMW
35-45	PROTEIN (%)	48-56
21-37	FAT (%)	18-25
4-20	ASH (%)	1-5
0,5-2	CHITIN (%)	0,2-1



Tenebrio molitor
Yellow MealWorm



Musca domestica , *Acheta domesticus*, as well as other species are used in insect-based aquaculture feed.

Protein Meals in Market

	Black Soldier Fly (BSF)	Yellow MealWorm (YMW)
Properties	Total %	Total %
Crude Protein	50-55	65-76
Digestibility	80-85	90-95
<i>Digestible Protein</i>	<i>40-46</i>	<i>59-72</i>
Fat	10-20	8-15
Σ SFA	60-83	25-40
Σ UFA	17-40	60-75
Fiber	8-15	5-10
Ash	2-10	1-5

AminoAcid Contents

Amino acid (%)	Salmon (Requirements)	MealProtein (Availability)	BSF* Protein Meal (Availability)
Arginine	6.0	9,7	4.7
Histidine	1.8	5,9	2.8
Isoleucine	2.2	9,4	4.0
Leucine	3.9	19,9	6.4
Lysine	5.0	10,2	5.8
Methionine 2/ Phenylalanine 4/	4.0	4.0	1.6
Threonine	2.2	7,7	4.0
Tryptophan	0.5	1,5	1.5
Valine	3.2	11	5.2

Fatty Acid Contents

Main Fatty Acids Content (%)		
	BSF	YMW
C12:0 – Lauric	25-35	-
C16:0 – Palmitic	15-20	15-25
C18:0 – Stearic	3-5	3-6
C18:1 – Oleic	12-15	30-45
C18:2 – Linoleic	20	15-30
ω-3	1,5	1,5
ω-6	20,6	31
ω-9	13	41
	GOOD FOR FATTENING Short Chain Saturated Fatty Acids are accumulated by fish	GOOD FOR GROWING Medium chain Saturated and Unsaturated are essential in metabolism routes



THANK YOU

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