



Gembloux Agro-Bio Tech
Université de Liège

Insectes comestibles et alimentation humaine : sans aucun doute ?



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Insectarium Jean Leclercq – Hexapoda, Waremme, Belgique
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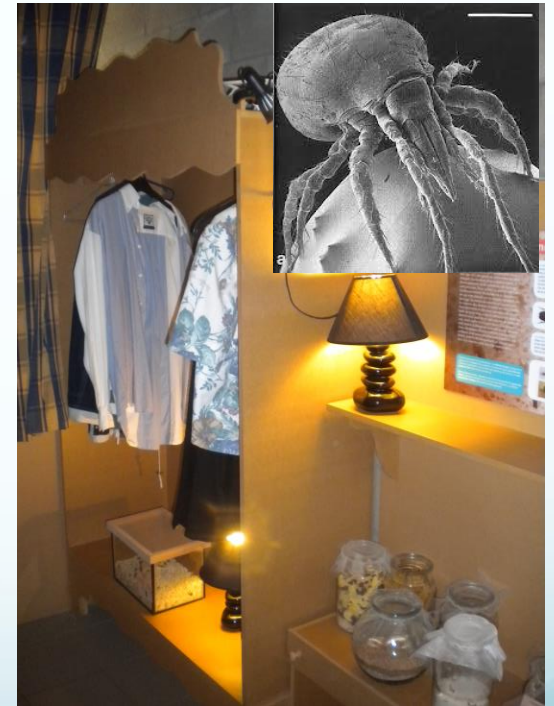
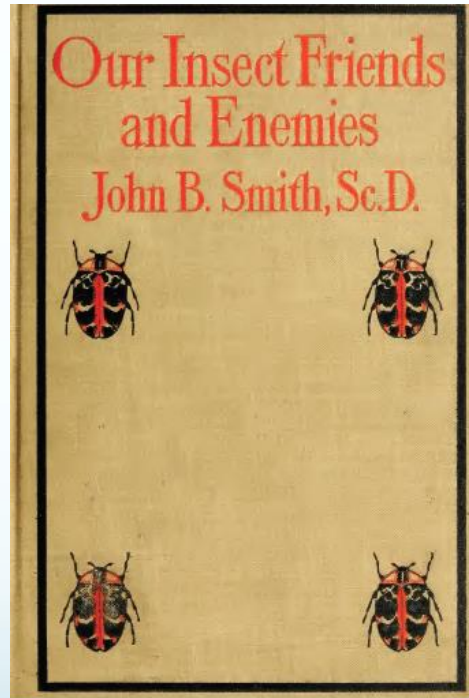
Introduction

Insectes : groupe animal le plus abondant et diversifié sur terre, impliqué dans divers food webs ... mais pas le plus apprécié ...



Introduction

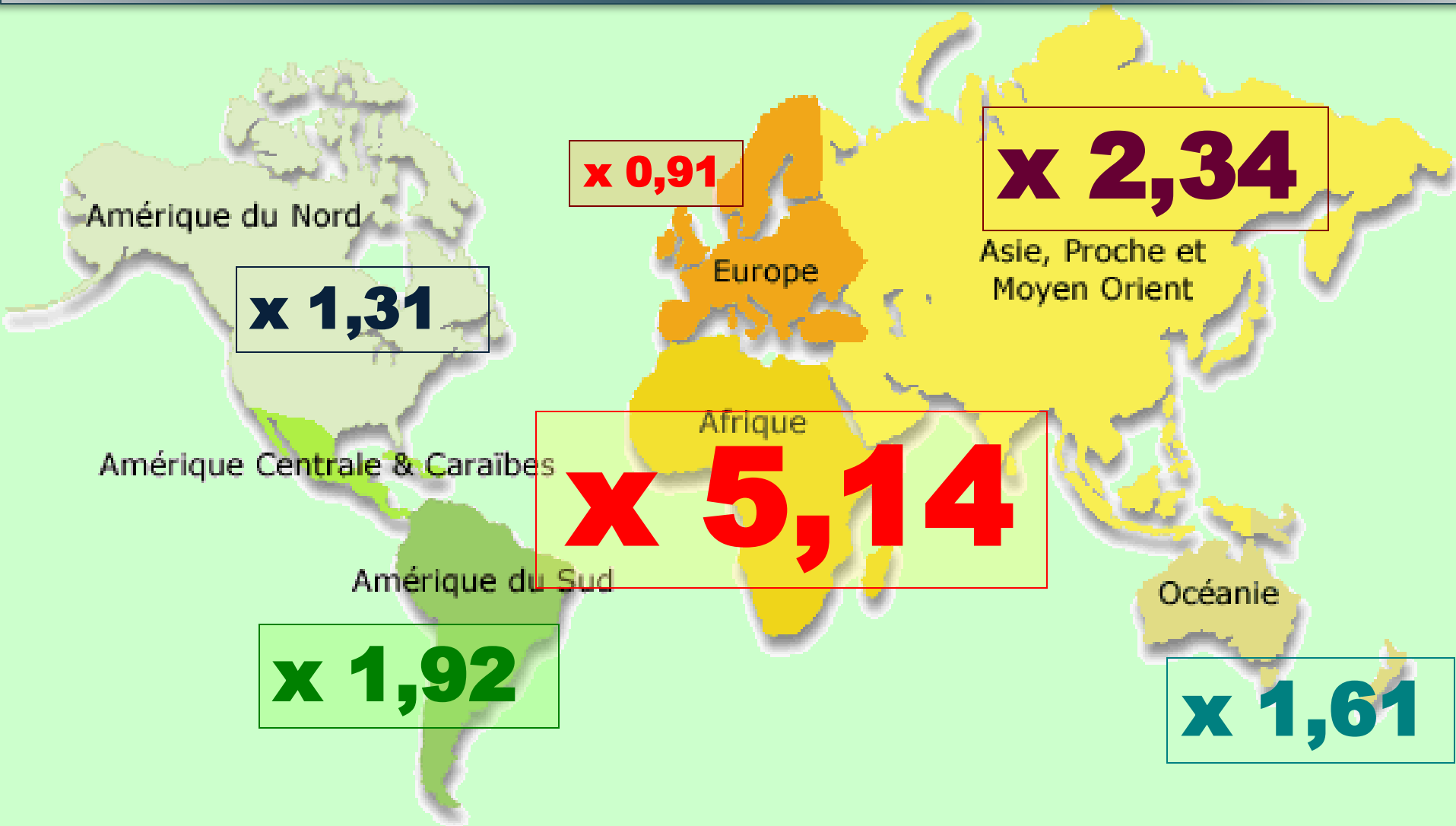
Smith (1909) « Our insect friends and enemies; the relation of insects to man, to other animals, to one another, and to plants »



... last chapter entitled « the war against insects ».

Les besoins alimentaires

Il faudrait augmenter de 70% la production agricole pour que tout le monde mange bien en 2050



Un français mange dans sa vie :

- 2 400 Kg de poissons et crustacés
- 32 000 litres de lait (**91 Kg laitages / an**)
- 20 000 œufs
- 7 bovins
- 33 cochons
- 9 chèvres et moutons
- 1 300 volailles
- 60 lapins

**85 Kg de
viande /
an**

**Un américain 125 Kg
Un chinois 56 Kg
Un africain 11 Kg
Un indien 6 Kg / an**



Les bonnes raisons de devenir un entomophage

(PLoS One, 5, e14445, 2010)

Species	CH ₄ (g/kg BM/day)	N ₂ O (mg/kg BM/day)	CO ₂ eq. (g/kg BM/day)	NH ₃ (mg/kg BM/day)
<i>Pachnoda marginata</i> (n = 4)	0.16±0.085 ^a	0.0±0.03 ^a	4.00±2.13 ^a	0.1±0.16 ^a
<i>Tenebrio molitor</i> (n = 4)	0.00±0.002 ^b	1.5±0.13 ^b	0.45±0.04 ^b	0.0±0.09 ^a
<i>Blaptica dubia</i> (n = 3)	0.08±0.021 ^c	0.3±0.24 ^a	2.12±0.57 ^c	3.0±1.63 ^b
<i>Acheta domesticus</i> (n = 4)	0.00±0.002 ^c	0.1±0.13 ^a	0.05±0.04 ^b	5.4±3.40 ^c
<i>Locusta migratoria</i> (n = 6)	0.00±0.017 ^c	8.0±13.50 ^b	2.37±4.02 ^c	5.4±1.65 ^c
Pigs	0.049–0.098	2.7–85.6	2.03–27.96	4.8–75
Beef cattle	0.239–0.283	N/A	5.98–7.08	14–170



Les bonnes raisons de devenir un entomophage

Pour 10 kg de nourriture :

- 1 kg de bœuf



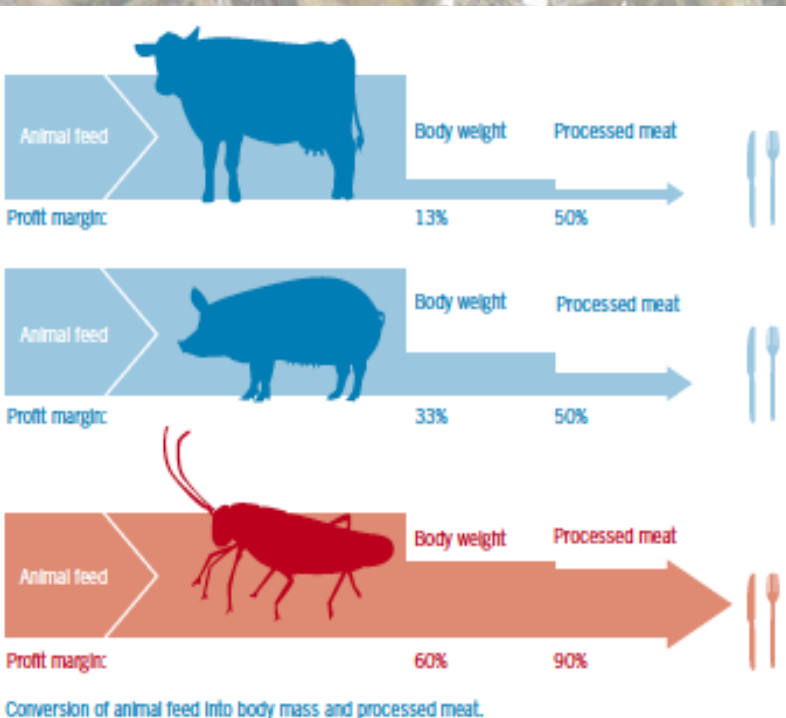
- 3 kg de porc



- 5kg de poulet



- 9 kg d'insectes



Les bonnes raisons de devenir un entomophage

- **Distant de l'homme = pas de transmission de maladie**
- **Meilleure conversion de la nourriture chez les insectes**
- **Excellente valeur nutritionnelle**
- **Moins de déchets et plus respectueux de l'environnement**
- **Plus de fertilité et croissance plus rapide**
- **Élimination du ravageur et apport alimentaire protéiné**

Pourquoi ne mangeons-nous pas d'insectes?

Facteurs culturels :

- Habitudes régionales et/ou religieuses

Facteurs individuels: seuil de perception et seuil d'identification

- Préférences/aversion
- Néophobies



Facteurs économiques:
facilité
d'approvisionnement acquis
et prix

Comportements innés
universels ...remplacés
par des comportements

Insecte proie-homme

Des insectes prédateurs à
l'homme ...

Opportunité similaire de
comprendre les relations
“food webs” fonction de la
diversité de proies et
origines géographiques

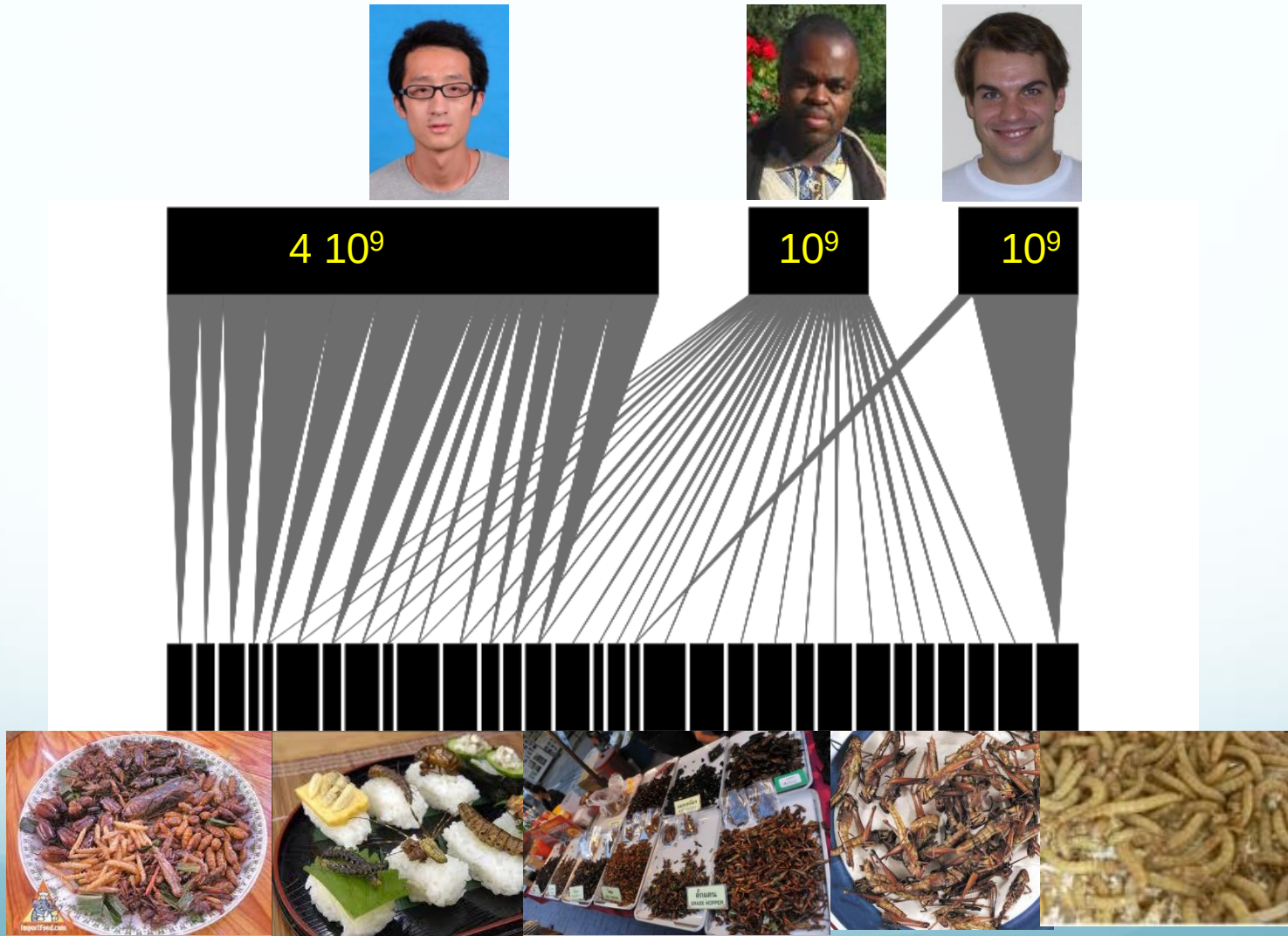


Des insectes ... c'est certains ?

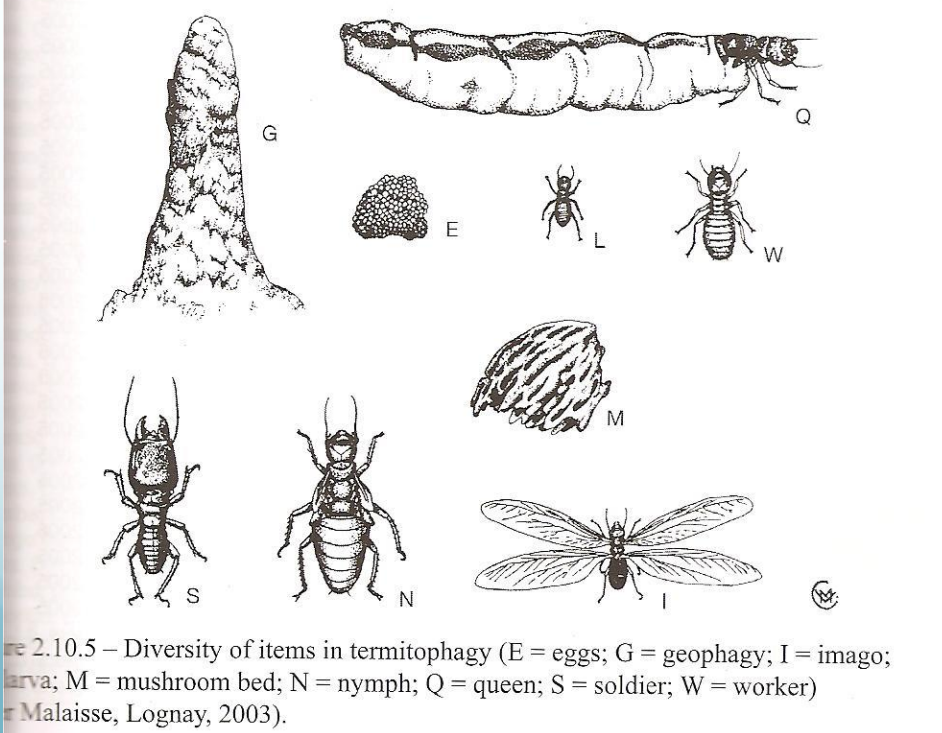


Insectes-homme

Comportements entomophages



Classiques: termites - chenilles



Entomophagie dans monde

In America (± 510 sp) :



In Asia & Oceania (± 340 sp) :



In Africa (± 530 sp) :

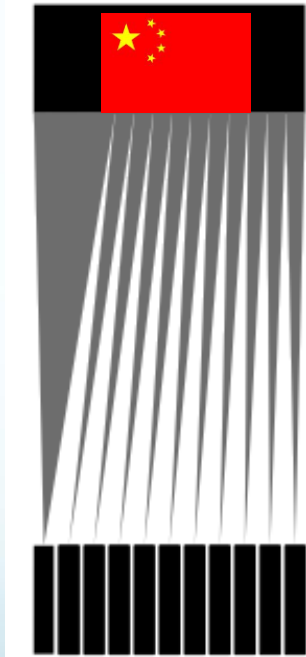


In Europe (± 30 sp) :



Insectes – homme

Focus géographiques ...



Chine :
diversité sur les
marchés



Vietnam :
quelques espèces



Insecte - homme

Focus géographiques ... suite



Europe:
ténébrions
et grillons



RDC:
Chenilles et
termites



Benin:
Crickets
et
Oryctes



Edible insects acceptance of Belgian consumer ?

Journal of Sensory Studies



Journal of Sensory Studies ISSN 0887-8250

EDIBLE INSECTS ACCEPTANCE BY BELGIAN CONSUMERS: PROMISING ATTITUDE FOR ENTOMOPHAGY DEVELOPMENT

RUDY CAPARROS MEGIDO^{1,4,5}, LUDOVIC SABLON¹, MÉLODIE GEUENS¹, YVES BROSTAUX²,
TAOFIC ALABI¹, CHRISTOPHE BLECKER³, DIDIER DRUGMAND⁴, ÉRIC HAUBRUGE^{1,4} and
FRÉDÉRIC FRANCIS^{1,4}

- Experiment was held in an insectarium
 - 384 visitors were recorded
 - 189 people participated to this study
- 49.2 % of the people!



8 Preparations



Boiled 6.5 min - Baked for 7 min (200°C) -
Baked + Vanilla - Baked + Paprika -
Baked + Chocolate



Boiled 8 min - Baked for 15 min (200°C)

Mixed
powder

Edible insects acceptance of Belgian consumer ?

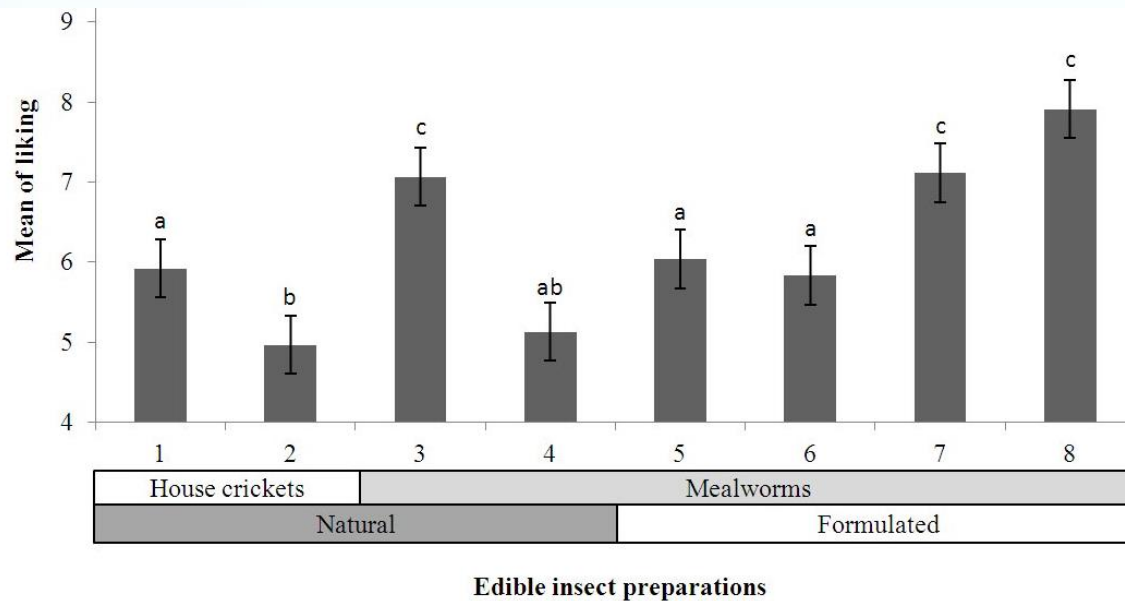


Figure 1: Liking of different meal preparations: (1) house crickets baked; (2) house crickets boiled; (3) mealworms baked; (4) mealworms boiled; (5) crushed mix of both species; (6) mealworms with vanilla; (7) mealworms with paprika; (8) mealworms with chocolate. Different letters show a significant difference for meal preparations at $P < 0.05$ (pairwise comparisons by Tukey's test).

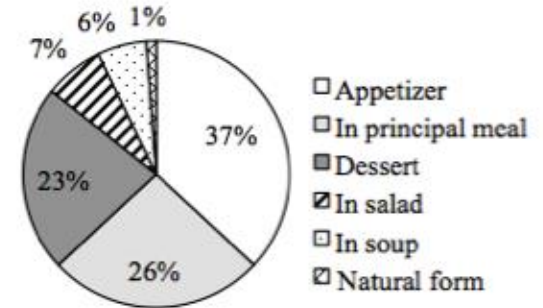
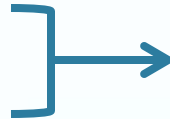


Figure 3: Responses (n = 97) to the question: "If yes, in which form would you cook insects?"



Insect-based meat substitutes?

- Experiment was held in a nutrition school
- Students from 18 to 25 y.o. were invited
- 79 students participated to this study and only 1 finally refused to taste preparations



4 Preparations



50 % of mealworms
45 % of beef



95 % of beef



50 % of mealworms
45 % of lentils



95 % of lentils



The last 5 % = Aromatic base composed of carrots, onions, tomato puree

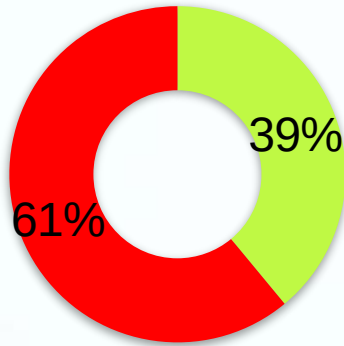
Are our burgers harmless?

Sample	Total bacterial count	Yeasts and molds
	$7.6 \cdot 10^4$	$1 \cdot 10^2$
	$1.1 \cdot 10^5$	$1.4 \cdot 10^2$
	$1.9 \cdot 10^5$	$1 \cdot 10^2$
	$1.7 \cdot 10^5$	$8 \cdot 10^1$
Limits for minced meat	$5 \cdot 10^5$	$10 \cdot 10^2$

~~*Escherichia coli*~~

~~*Clostridium perfringens*~~

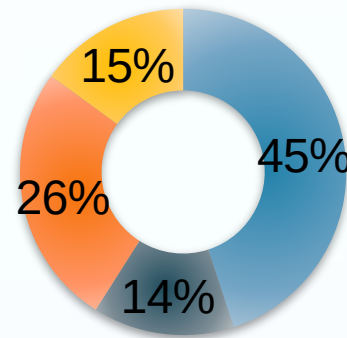
Do you know entomophagy ?



■ Yes
■ No

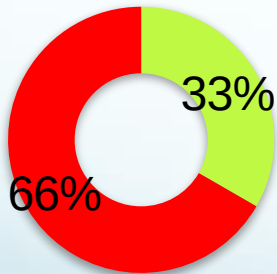
Entomophagy ?

Trough which channel ?



■ Television
■ Radio
■ Internet
■ Newspaper

Have you already eaten insect ?



■ Yes
■ No



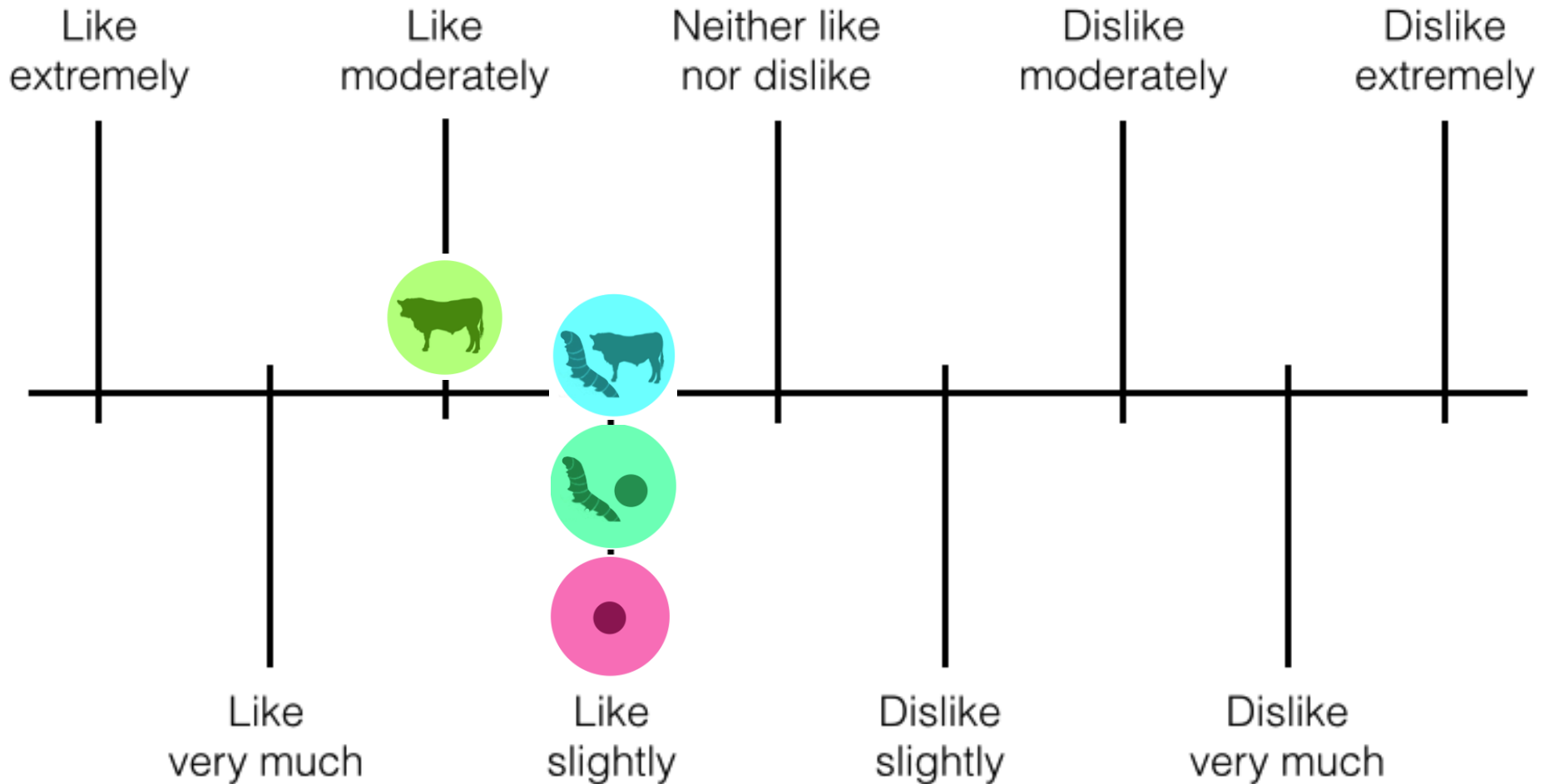
88%

■ Yes
■ No



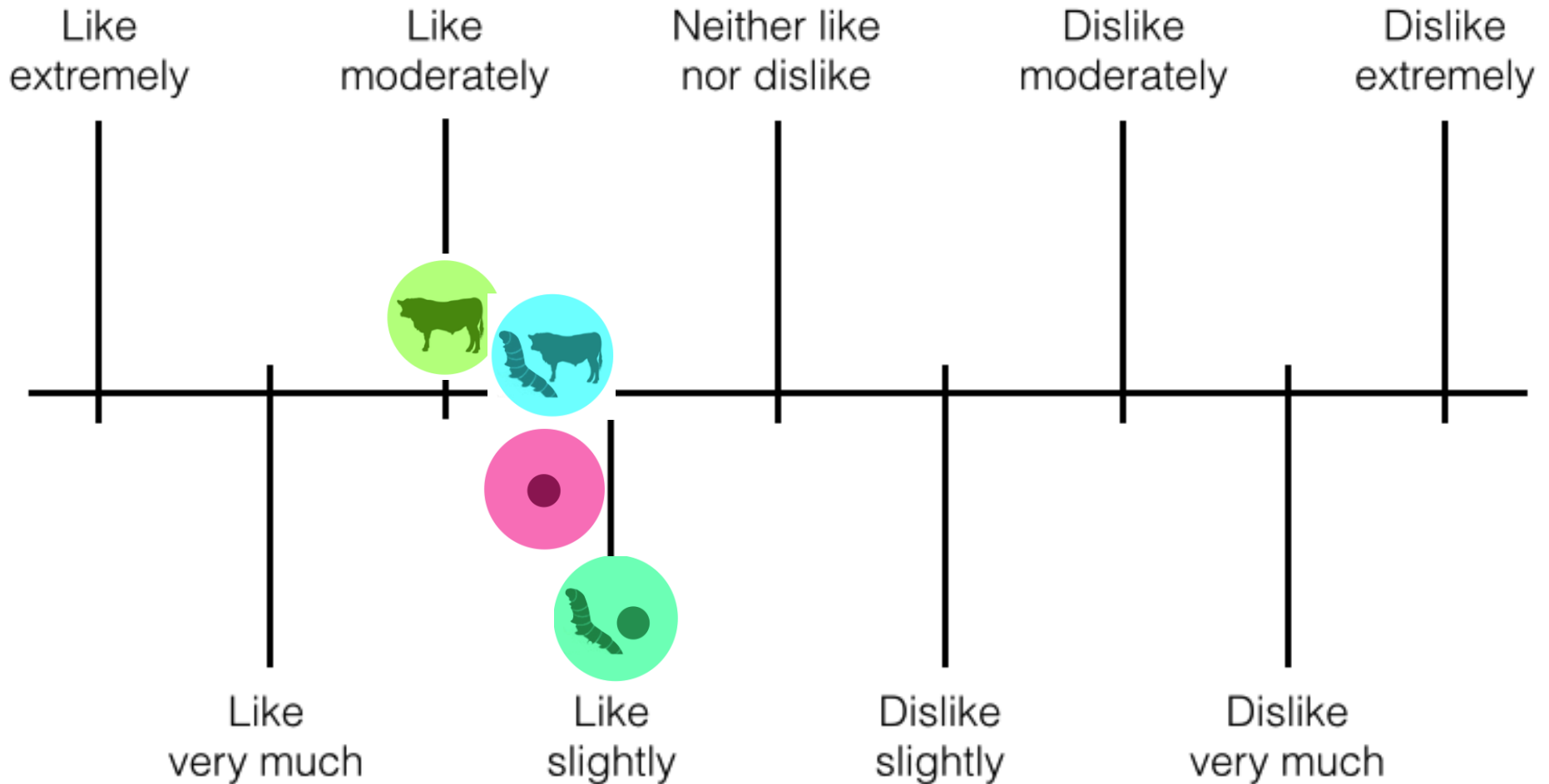
Insect-based meat substitutes?

Global appreciation



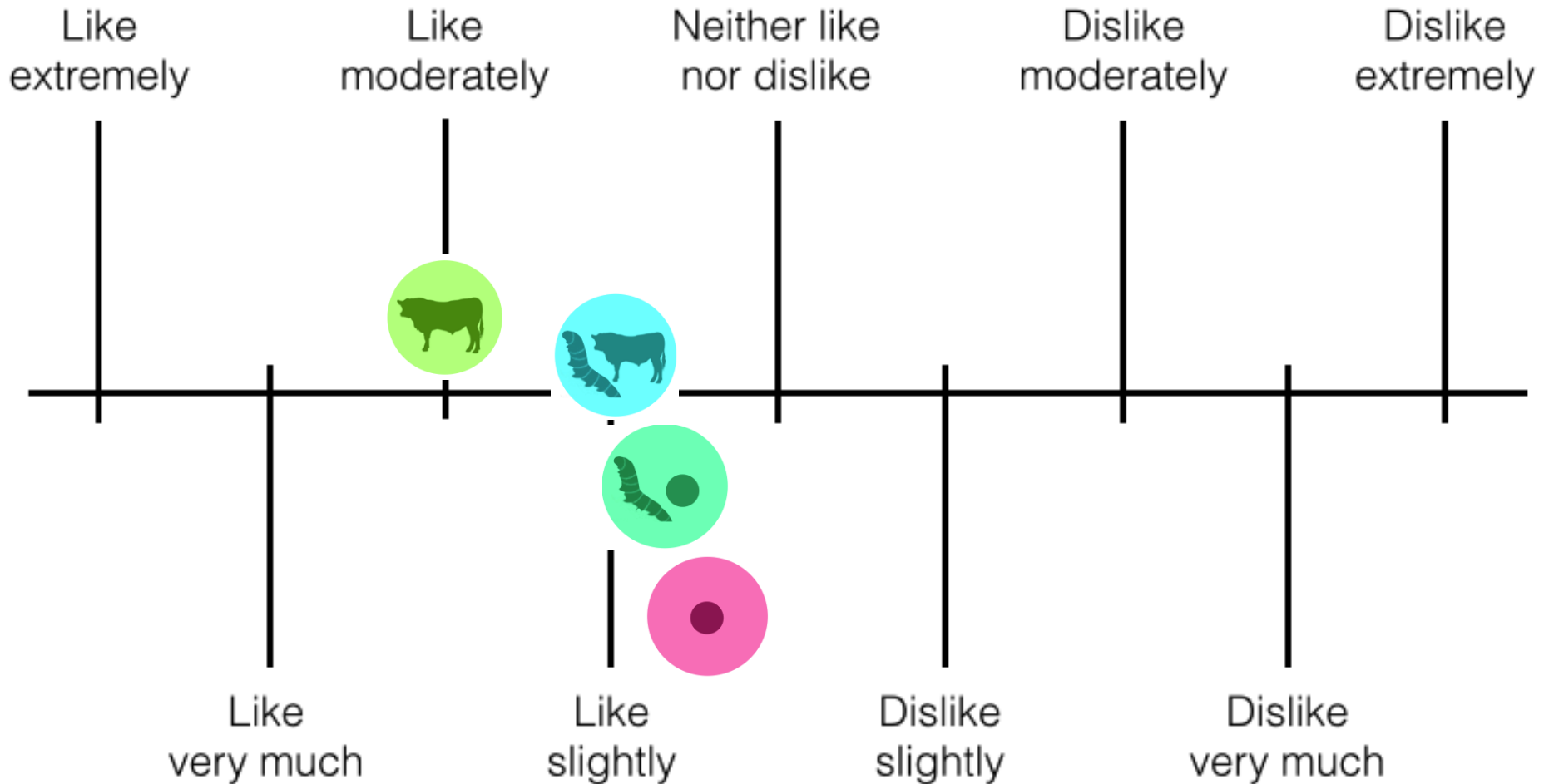
Insect-based meat substitutes?

Smell appreciation

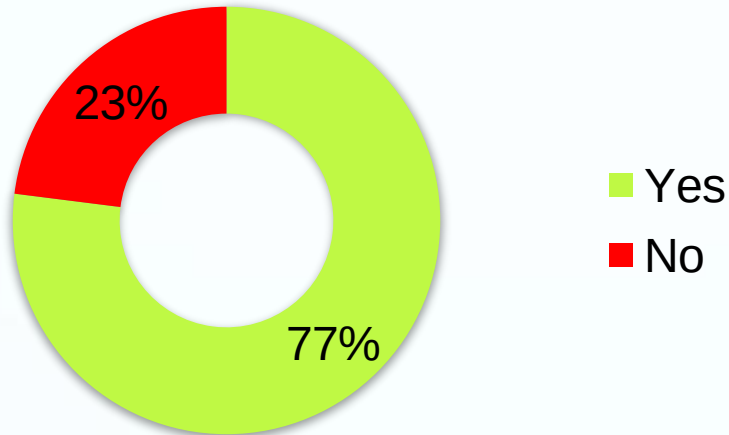


Insect-based meat substitutes?

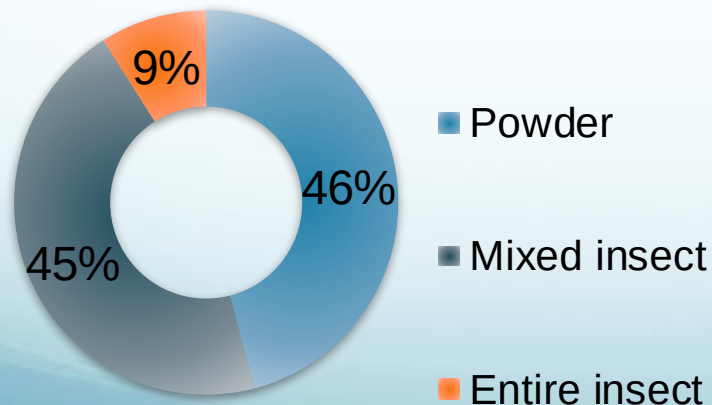
Taste appreciation



Do you think we will eat insect in the future?

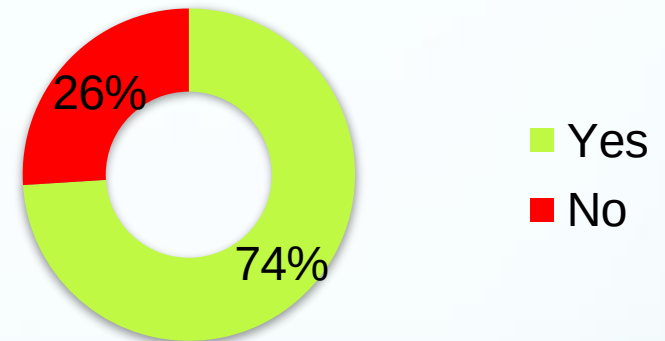


In what form ?



Future of Entomophagy ?

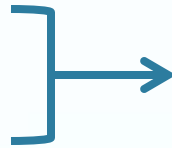
Are you open to insert insects in your food custom ?





Hide or not insect ?

- Experiment was held in an college school
- Students from 17 to 18 y.o. were invited
- 135 students participated to this study and only 26 finally refused to taste preparations



3 Preparations



Mealworms breads



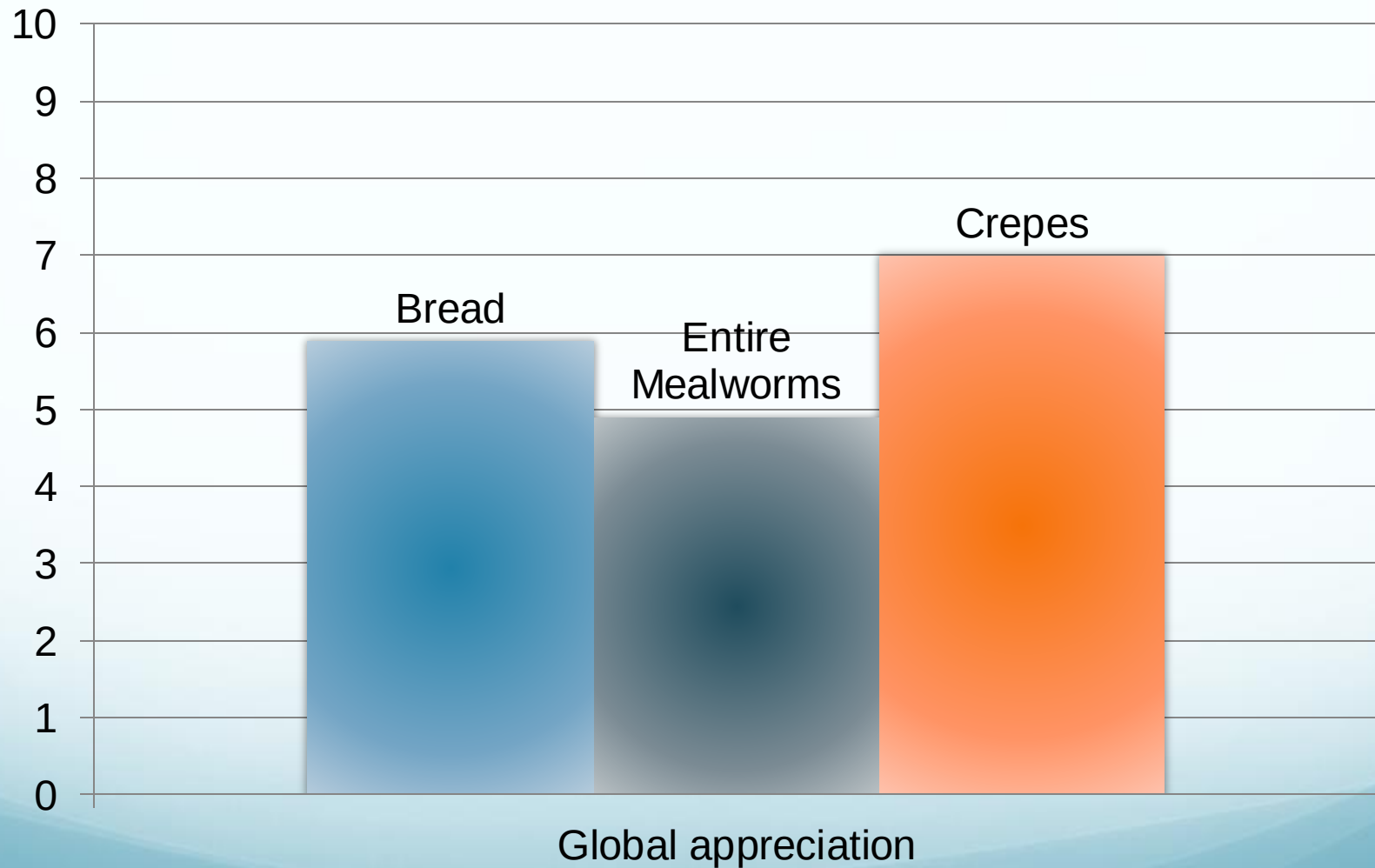
Mealworms



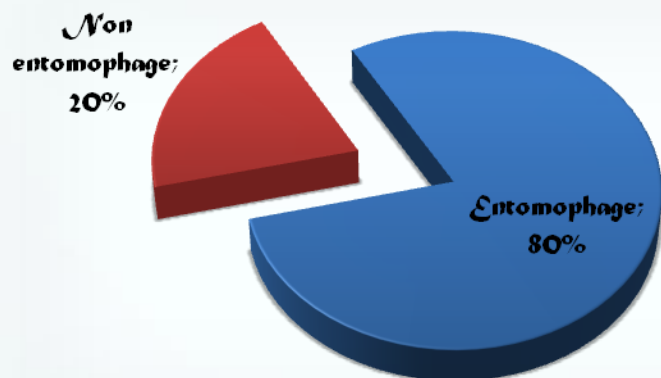
Mealworms crepes



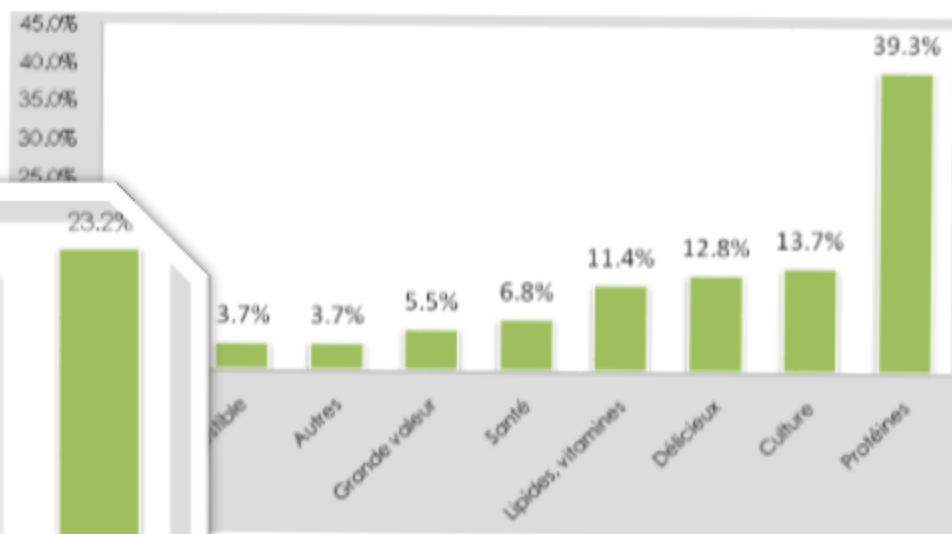
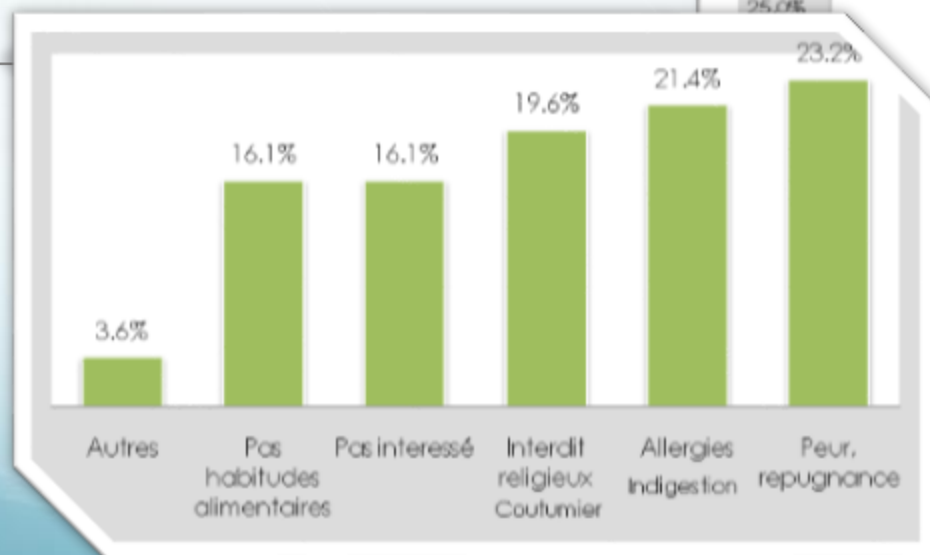
Preliminary results



Comportements Entomophages à Kinshasa

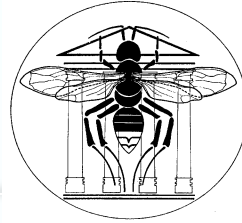


Motivations for insects as food



N'sevolo et al (2014).

Annales de la Société
Entomologique de France



Production durables d'insectes pour l'alimentation animale et humaine Entomofood

Spin-off de Gembloux Agro-Bio Tech –
Université de Liège

Strategies and developed activities

Mealworm



Grillids



Rearing optimisation and Scaling-up

Valorisation of agro-residues in diets

Evaluation of biological performances and profitability

Analysis of quality – composition related to diet

Selection of best conditions and packaging

Conservation Of insects

Feed

Alimentation animale dont NAC

Food

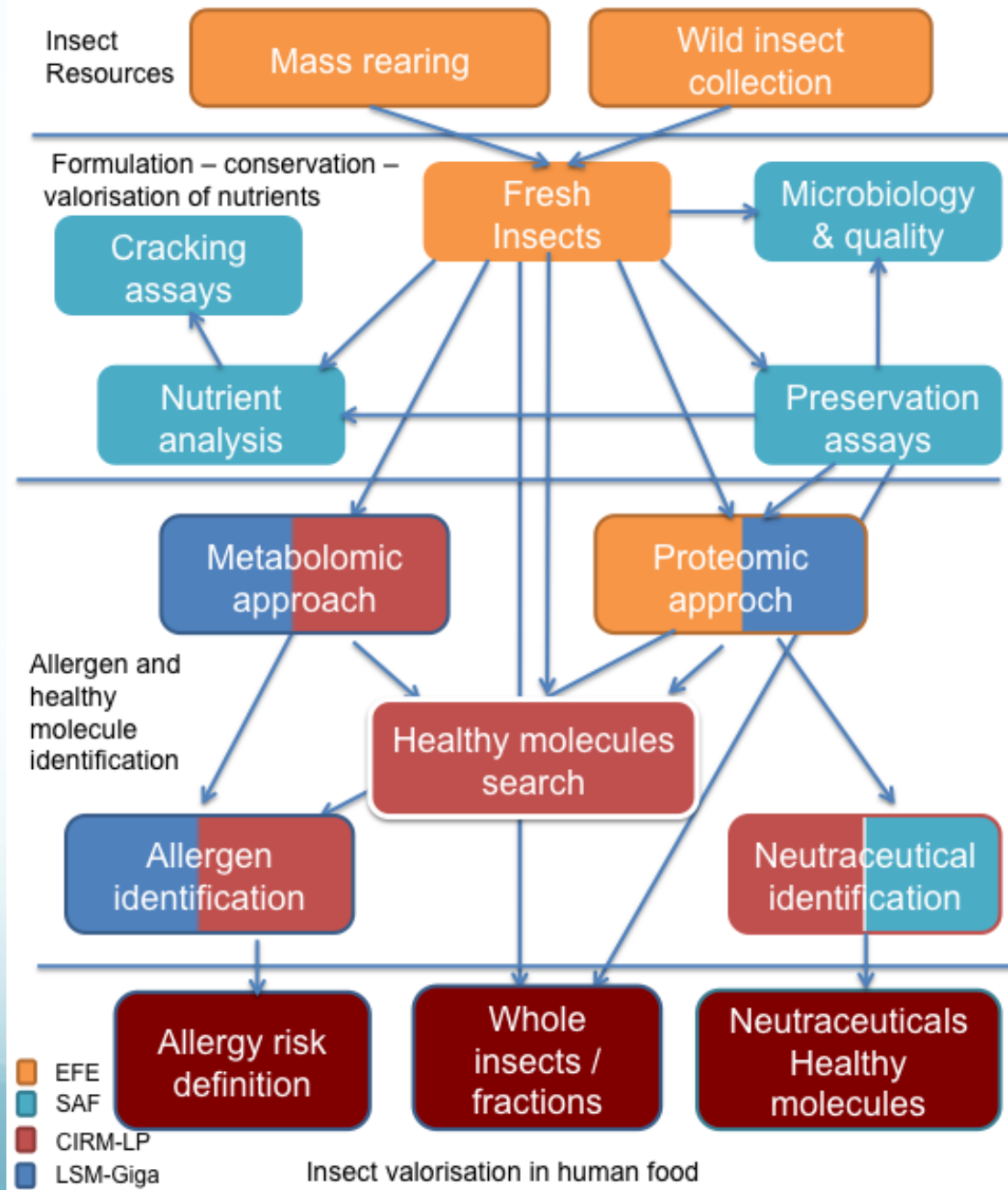
Human food

Law & rules - Quantification of market niches

Agro-Industries

Animal food and fishery shops

Food distribution



**Multidisciplinary
approaches for
edible insect use**

at

**Gembloux
Agro-Bio Tech**

**University
Liege of**

Take home message ?

- Promotion de l'entomophagie
- Ténébrions et criquets ciblés
- Insectes cachés : mixés ou en poudre
- Préparations à base d'insectes bien acceptées



Livre de recettes d'insectes

“Six pattes et si délicieux”

Caparros Megido Rudy

r.caparros@ulg.ac.be

<http://www.gembloux.ulg.ac.be/entomologie-fonctionnelle-et-evolutive/>

