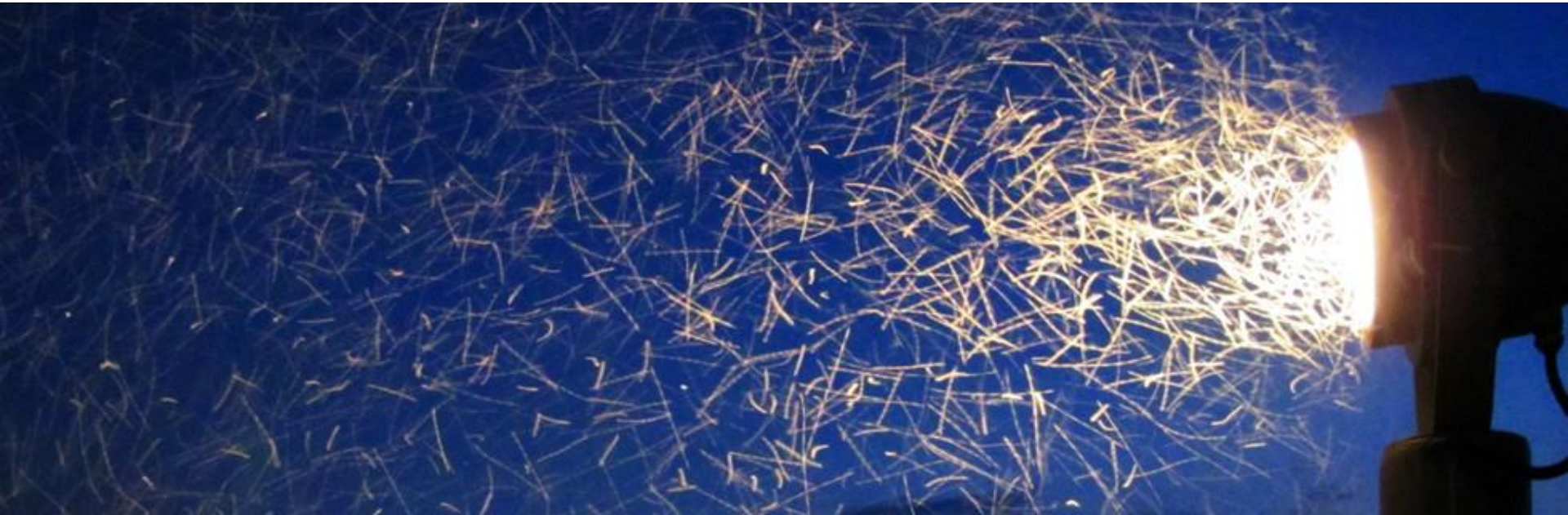




Bringing a new resource to light



Processing & Trade



Workshop thematic

- (1) Ethnology
- (2) Farming Insect
- (3) Insect Food & Feed
- (4) Nutrition
- **(5) Processing & Trade**
- (6) Communication & Awareness
- (7) Legislation & Regulation
- (8) Food Policies & Security



(5) Processing & Trade: Storyline

- **Processing:** a transition from small-scale to large-scale processing
 - Widespread entomophagy will only occur if it can fit into the current industrial context
 - Large-scale insect industry will rely on automated insect treatment processes
- Trade: a sustainable trade for 9 billion people in 2050
 - Main protein-rich raw materials (PRRM) are no longer sustainable
 - Some answers can be found, insect proteins are one of them
 - Insect is altogether a natural, efficient & sustainable alternative to PRRM
 - To be successfully accepted, insect trade must remain sustainable



Widespread entomophagy will only occur if it can fit into current industrial context



	Current status: Artisanal output Raw Insects	Prospective status: Food industry ingredient Insect meals & constituent separation
Application	Human consumption: roasted or boiled Pet food: live (reptile,...)	Can act as a building block for many current products Human consumption (steak, energy bars, cakes,...) Animal-rearing feed: fish & poultry Pharma & cosmetology: chitin & peptides
Conservation	High water content deters conservation rate	Dry & compactible product Easy to store & conserve
Transportation	Cold chain needed	Easy to handle No cold chain needed
Waste	High waste amount on the carcass of big insects	Separation in basic constituents (protein, fat, chitin) leaves very few waste
Industry scale	Small to medium	Large
Standardization	Very poor: depends of the origin of insects	Development of national and international standards Safety, Stability & Quality are monitored in the facility
Consumer acceptance	Relative to countries cultural habits	Long-term cultural shift (western countries) : 1 generation

A large-scale insect industry will rely on automated insect treatment processes

Processes of interest from existing Industries

Ground steak

- Trituration
- Grinder
- ...

Fish (surimi)

- Block formation
- Odor removal
- Cold extrusion
- ...

Crustaceans

- A&L removal
- Chitin removal
- ...

Of course, an automated treatment process should go along with an automated rearing process

Primary parameters

A.Domesticus

Carcass chitin content	≈ 10% of DW
Weight of Antennas, Legs & Wings	Up to 10%
Easiness to get rid of A,L&W	good
Insect section	0,8cm x 0,8 cm
Insect length	3,25 cm
Insect weight	≈ 2 g
Density	≈ 960 kg/m ³
Insect water content	69,2%

Questions / Topic to discuss

- Transportation between rearing ground & transformation units
- Reduce antennas, legs & wings weight through selection
- Chitin usage and application

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Main protein-rich raw materials (PRRM) are no longer sustainable

SOYBEAN-BASED MEAL

BENEFITS

- Only vegetable able producing mandatory 8 aa
- Soybeans meals get a 42 to 48% proteins share
- Lysine-rich material: good complement to cereals
- Good digestibility for every type of animals
- Economical : imported at relatively low cost

DRAWWBACKS

- **Large-scale Deforestation** (=> cultivation)
- Difficulty in providing a “GMO free” soya
- Cheap for a long time, prices recently reached back their 1973 US embargo heights

Aliment Chicken (Broiler)	% of aliment total weight
Cereals (Corn, Wheat, Triticale...)	71%
Soybeans meal	14,5%
Grain Legume (Soya excepted)	10%
Vitamins & minerals complement	4,5%



Main protein-rich raw materials (PRRM) are no longer sustainable

FISH BASED MEAL

BENEFITS

- Natural feed for carnivorous fishes
- Protein-rich (65 to 70% DW): provide majority of proteins in fish feeds
- Fish meal as allowed aqua farming development

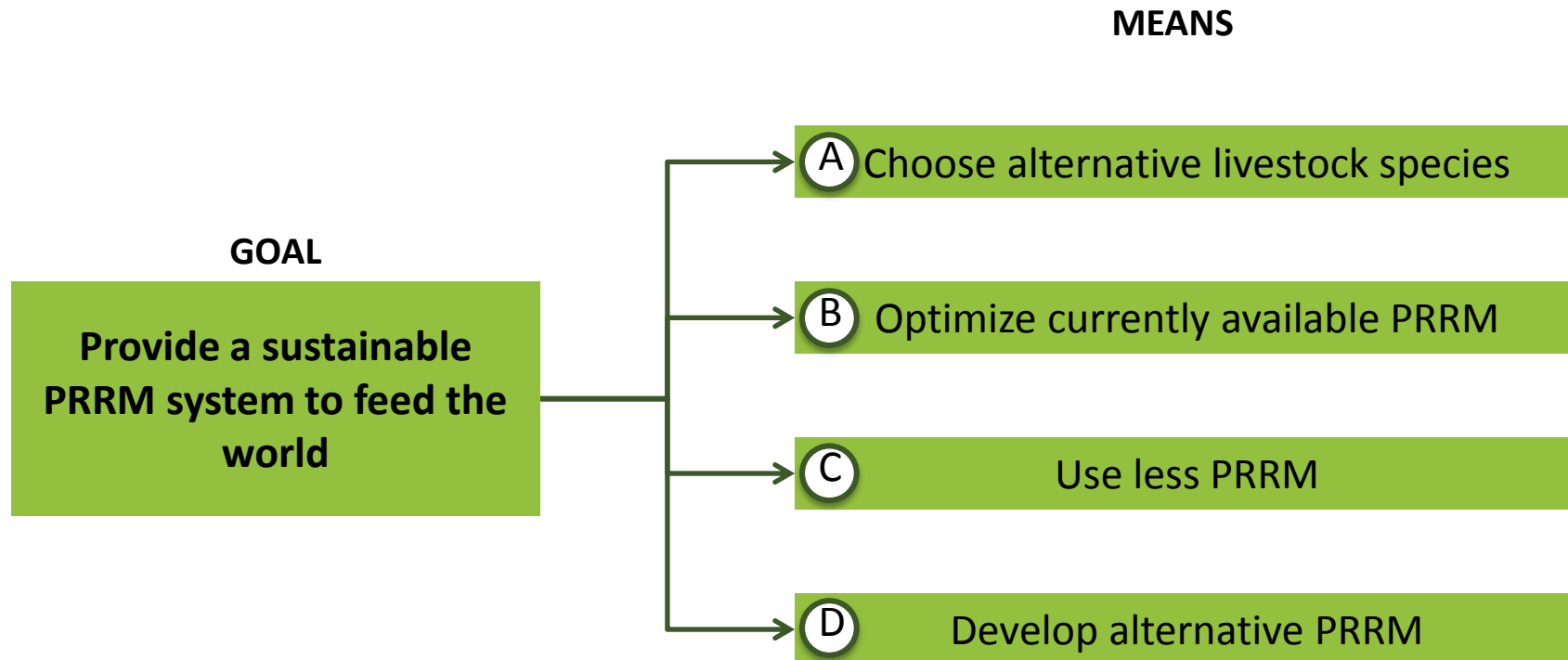
DRAWBACKS

- Fish meal from industrial fishing => **global fish stocks scarcity**
- Worldwide fish stock depletion => stagnant 93 Mt fish production
- Different quality: processing & cannery wastes also used to produce fish meal poor in protein (<65%) and rich in mineral

Aliment Trout	% of aliment total weight
Grain Legume (soya excepted)	23,0%
Soybean meal	21,0%
Fish meal	20,1%
Vegetable oil	15,7%
Cereals	8,0%
Animal oil	8,0%
Vitamins & minerals complement	4,0%



Some answers can be found, insect proteins are one of them



Some answers can be found, insect proteins are one of them

MEANS ANSWERS LIMITATIONS

A Choose alternative livestock species → Aqua farming : use of tropical species as the vegetarian tilapia

- Problem transfer to soya

B Optimize currently available PRRM →
More vegetables and less meats in animal feed
Animal meal used only to “finish” the animal

- Animal-rearing issues (illness, deprivation...)
- Problem transfer to soya

- Organoleptic qualities degradation
- Problem transfer to soya



Some answers can be found, insect proteins are one of them

MEANS

ANSWERS

LIMITATIONS

C

Use less PRRM

Consumer education: less meat
daily intake

Transition to less intensive and
more extensive rearing

- Cultural shift long to establish

- Need to ensure a high level of
production

D

Develop alternative
PRRM

Other Grain legumes: lupin,
clover, vetch,...

**Insect proteins
(meals, isolate)**

New GMO developments

Transformed animal proteins
(TAP)

- Lack of some mandatory
amino-acids

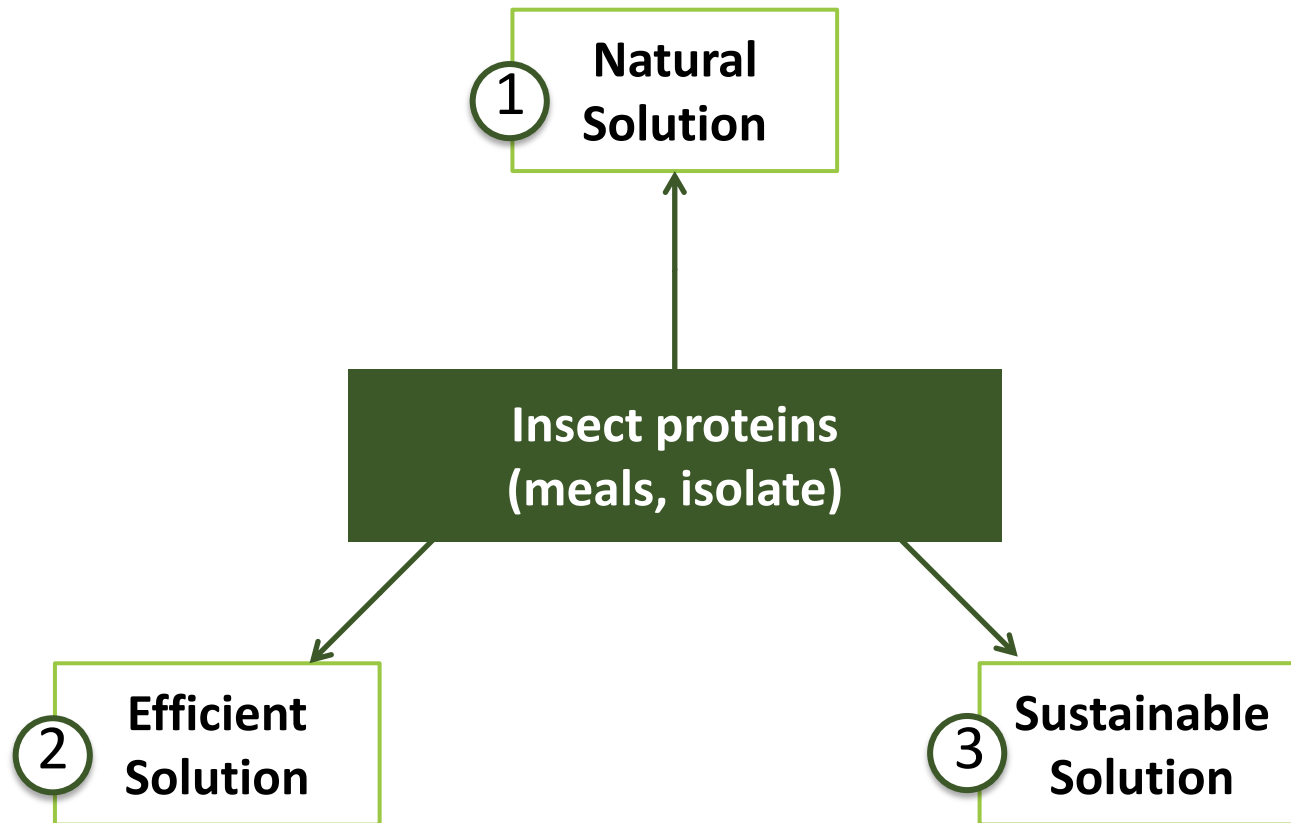
- Need to develop the industry

- Strong opposition of
consumers (especially EU)

- Adverse regulation
- Bad Public image (BSE)



Insect is a natural, efficient & sustainable alternative to PRRM



Insect is a natural, efficient & sustainable alternative to PRRM

Insect proteins
(meals, isolate)

1 Natural
Solution

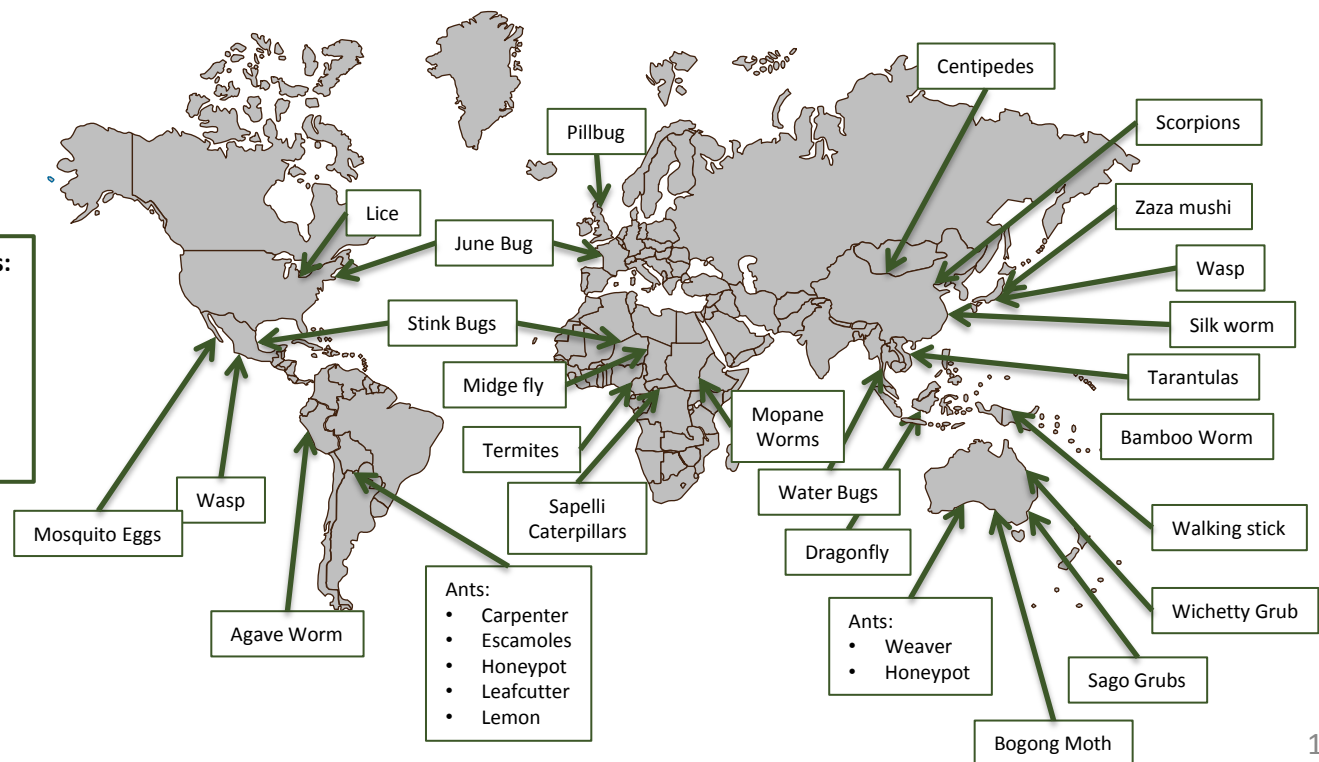
3/5 of human population has a culture **familiar with insects**.
Fishes & poultry **naturally eat insects**

Well-being factor in animal rearing

Each region of the globe gets **several** interesting insects

Famous Worldwide species:

- Crickets
- Cicada
- Waxworm
- Bees
- Mealworm
- Grasshoper



Insect is a natural, efficient & sustainable alternative to PRRM

Insect proteins
(meals, isolate)

2

Efficient
Solution

Protein **profile is well adapted** to fishes & poultry (no need of amino-acid addition)

Answers to **fat specific needs** (rich in $\omega 3$ and $\omega 9$) for fishes & poultry (important to guaranty good organoleptic qualities)

1st test on poultry shows a **weight gain equal or superior** to other animal meal and soybeans meal

Table : Bee Meal Vs. Soybeans Meal

	Bee Meal	Soybeans meal
Dry weight (g/kg)	906,0	889,0
Raw Proteins (g/kg DW*)	684,3	517,0
Fat (g/kg MS)	81,6	22,9
Available Energy (MJ/kg MS)	12,1	12,1

*DW : Dry Weight

Insect is a natural, efficient & sustainable alternative to PRRM

Insect proteins
(meals, isolate)

3 Sustainable
Solution

Economic:

- Expected **lower cost** of insect production industry **vs other animal industry**

Ecologic:

- Insect rearing **needs very few water, feed, energy and space**
- Insect can make a good **use of currently non-used organic materials** (Agro-industry, catering, ...)

Social:

- An opportunity to create a **new industry**, and **new activities**
- Indirect impact on **deforestation and ocean plundering**
- Good **nutritive value**, vitamins, fat ($\omega 3$ $\omega 9$), insects are healthy food

Table : Raw insect nutritional data

	A.Domes ticus (Imago)	T.Molitor (Larvae)
Water (%)	69,2	59,4
Raw Proteins (% DW*)	64,2	49,1
Fat (% DW)	22,1	40,6
Fibres (% DW)	10,1	6,6
Ash(% DW)	3,6	2,8

*DW : Dry Weight

Processing & Trade : Question & Topic to discuss



Insect vision:

- Keep local species in region
- Focus industrialisation on species which are already scientifically known and studied
- Remain sustainable (main strength and marketing argument of insects)

Processing

- **Transportation** between rearing ground & transformation units
- Reduce antennas, legs & wings weight through **selection**
- **Chitin** and **manure usage** and **applications**

Processing & Trade : Question & Topic to discuss



- Ecologic
 - Reduce high carbon transport cost => **intra region trade**
 - **Ecological threat** => insect “leaking” from insect farming (highly probable)
- Social
 - Consumer sensibility
 - **Cultural habit**
 - ↗ Consumers give **value to ecological properties of their food**
 - **Health value** of insect through its nutritive benefits
 - Promotion of **local species**
 - Provides **extra jobs & extra incomes locally**
- Economic
 - **Access technologies** => lower production cost & **increase volume output**
 - Assess interest of **organic waste as resource** => **feasibility** (contamination, N content...) **resource use competition** (energy, fertilizer, materials) and **legislation issues**
 - Need to **invest in R&D** to help creation of new solutions and get a better understanding of insect as feed and food
 - Need for **industry association** working on common issues (HSEQ, accept. => sustainability R&D) => tech guidelines & communication => legislation





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www.ynsect.com

Thank you !

