

# Insect as feed



## MASS PRODUCTION/ORGANIC SIDE STREAMS

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Bionomy, Systematic and Applied Research on insects (Diptera)

### Expert consultation

FAO/WUR Meeting: "Assessing the Potential of Insects as Food and Feed in assuring Food Security", 23-25 January 2012, Lebanon Room (D209), FAO, Roma, Italy



# Animal feed → challenges (I)



- Animal feed has implications for the **quality** of the livestock products.
- World population will exceed **9 billion** by mid-century.
- **Size of livestock-industry** has increased, while the number of farms has decreased.
- The trend to **concentration**, with specific industry practices has substantial impacts on *human health, animal welfare*, and causes *pollution* problems associated with **animal waste**.
- **Inefficient** process & raw material **bottlenecks**

## Animal feed –> challenges (II)



- **Raw material bottleneck -> fish meal/oil**
- Mainly aquaculture but
- ... also used with livestock (poultry and pigs, etc.)
- Wild fish stocks are limited resources...
- It is necessary to ensure a sustainable supply of high quality animal feed → insects could be the solution?

# Feed vs Food ?

- “Insects as feed” → 2,100 results
- “Insects as food” → 155,000 results



## Edible forest insects

[www.fao.org/forestry/65422/en/](http://www.fao.org/forestry/65422/en/) - Traducir esta página

5 days ago – Edible **insects as feed** for livestock and fish. Insects are a healthy and sustainable food source for animals. Because of there high protein ...

## Edible forest insects

[www.fao.org/forestry/65429/en/](http://www.fao.org/forestry/65429/en/) - Traducir esta página

4 Apr 2011 – In temperate zones, insect rearing companies produce **insects as feed** for reptiles and primates. In the Netherlands three such insect growers ...

## Insects as feed - FAO

[www.fao.org/forestry/72669/en/](http://www.fao.org/forestry/72669/en/) - Traducir esta página

8 Dec 2011 – **Insects as feed** for livestock and fish. Chickens fed with black soldier flies. Given that some regions use insects as an alternative protein source ...

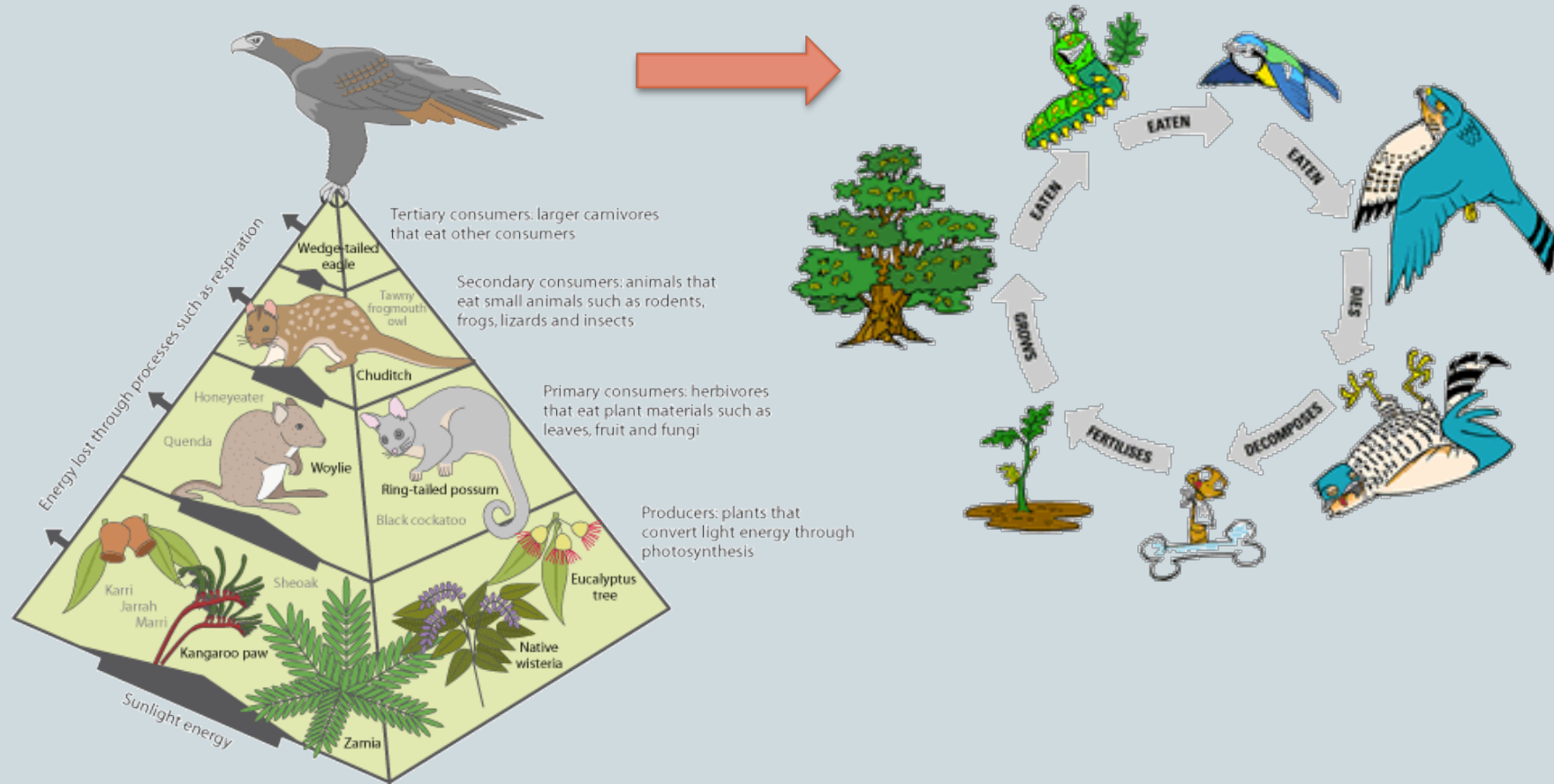
# Insects as feed -requisites



- Mass-rearing at industrial scale it is necessary
- Low cost production
- Sustainable process
  - Environmental point of view
  - Economical point of view
- It is possible?

# Yes... mimicking Nature

- Ecosystem equilibrium



Images adapted from:  
<http://www.westone.wa.gov.au/Pages/CopyrightDisclaimer.aspx>  
<http://www.rspb.org.uk/>



# Organic waste → organic side streams



Part of the problem (flies)...  
.... could be solution (larvae)

# Insects as feed and decomposers?

 **Ecodiptera**  
*Life*

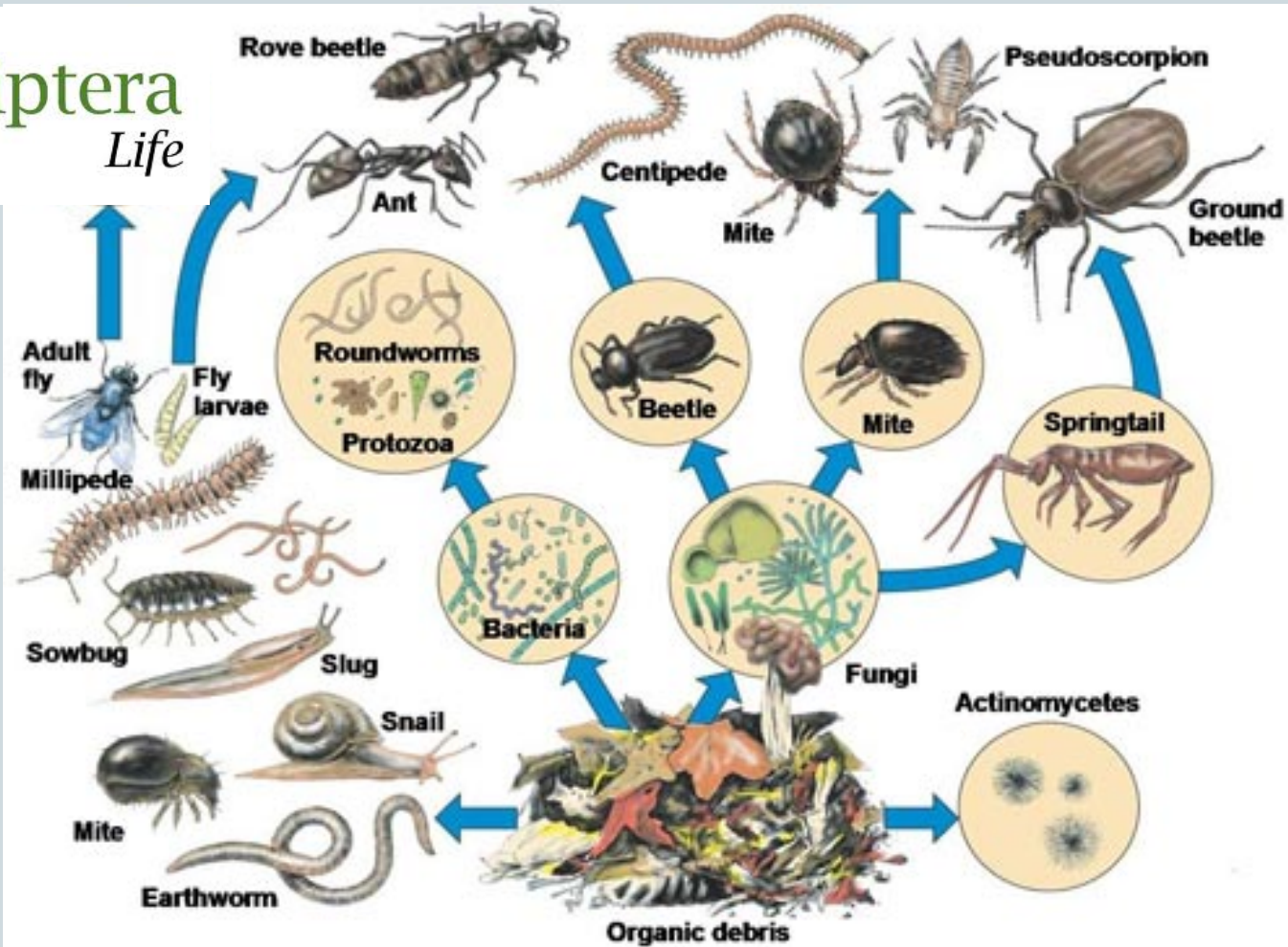
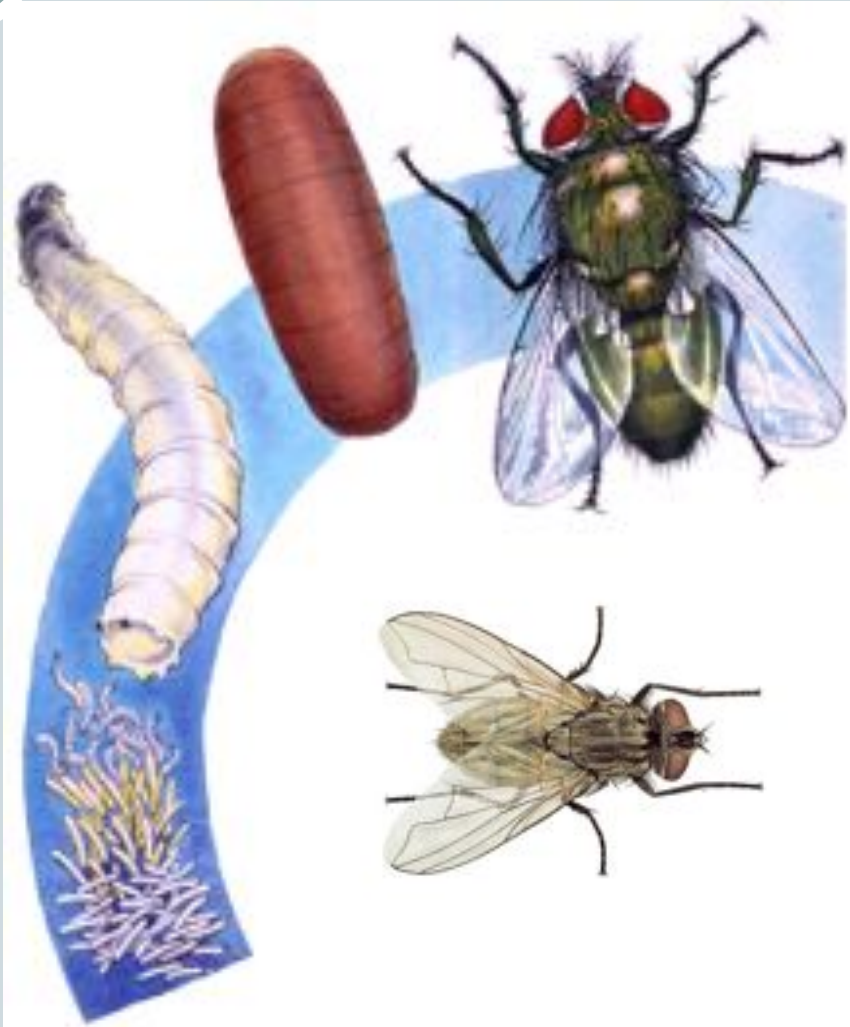


Image from:  
<http://www.imbt.org/index.htm#>



# Why no flies?

- Holometabolous  
larva vs pupa vs adult
- Huge biodiversity  
+ 150.000 spp
- Captive/Mass-rearing  
easily... theory...
- Multivalent uses



Images adapted from:  
NSW Agriculture & <http://www.ah.novartis.com>

# ECODIPTERA project



UNIVERSITY OF ALICANTE (SPAIN)  
INSTITUTE OF ZOOLOGY (SLOVAKIA)  
FINNISH MUSEUM OF NATURAL HISTORY



[www.ecodiptera.info](http://www.ecodiptera.info)

- Samples of organic media
- Physical / Chemical Analysis







## Effect of treatment on pig manure



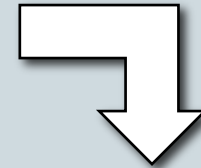
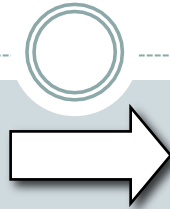
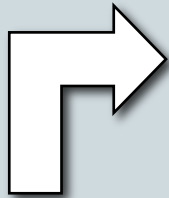
*Pig slurry (liquid)*



*Pig manure (solid)*

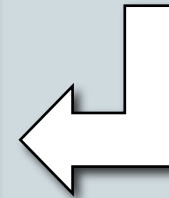
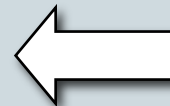
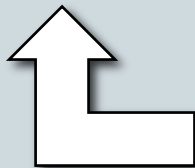


# Insects as feed and decomposers?

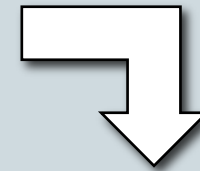
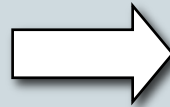
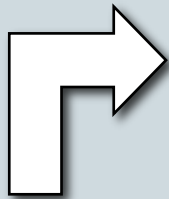


**Pig slurry (liquid)**

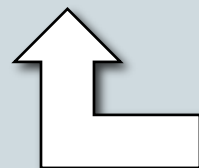
**Hoverflies (Syrphidae) *Eristalis tenax***



# Insects as feed and decomposers?



**Pig manure (solid)**  
**Coprophagous Muscidae**

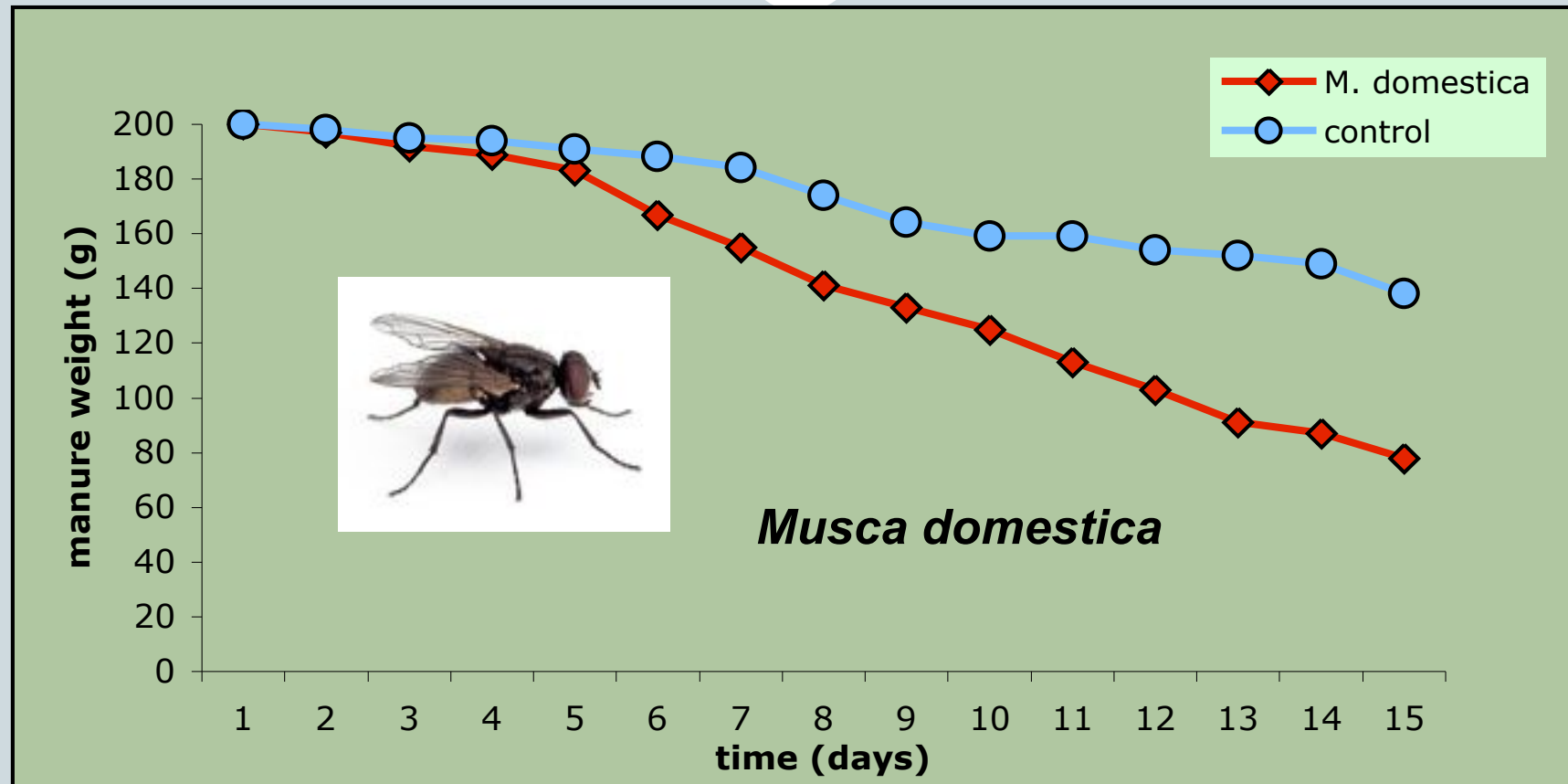




# Species selection for mass-rearing

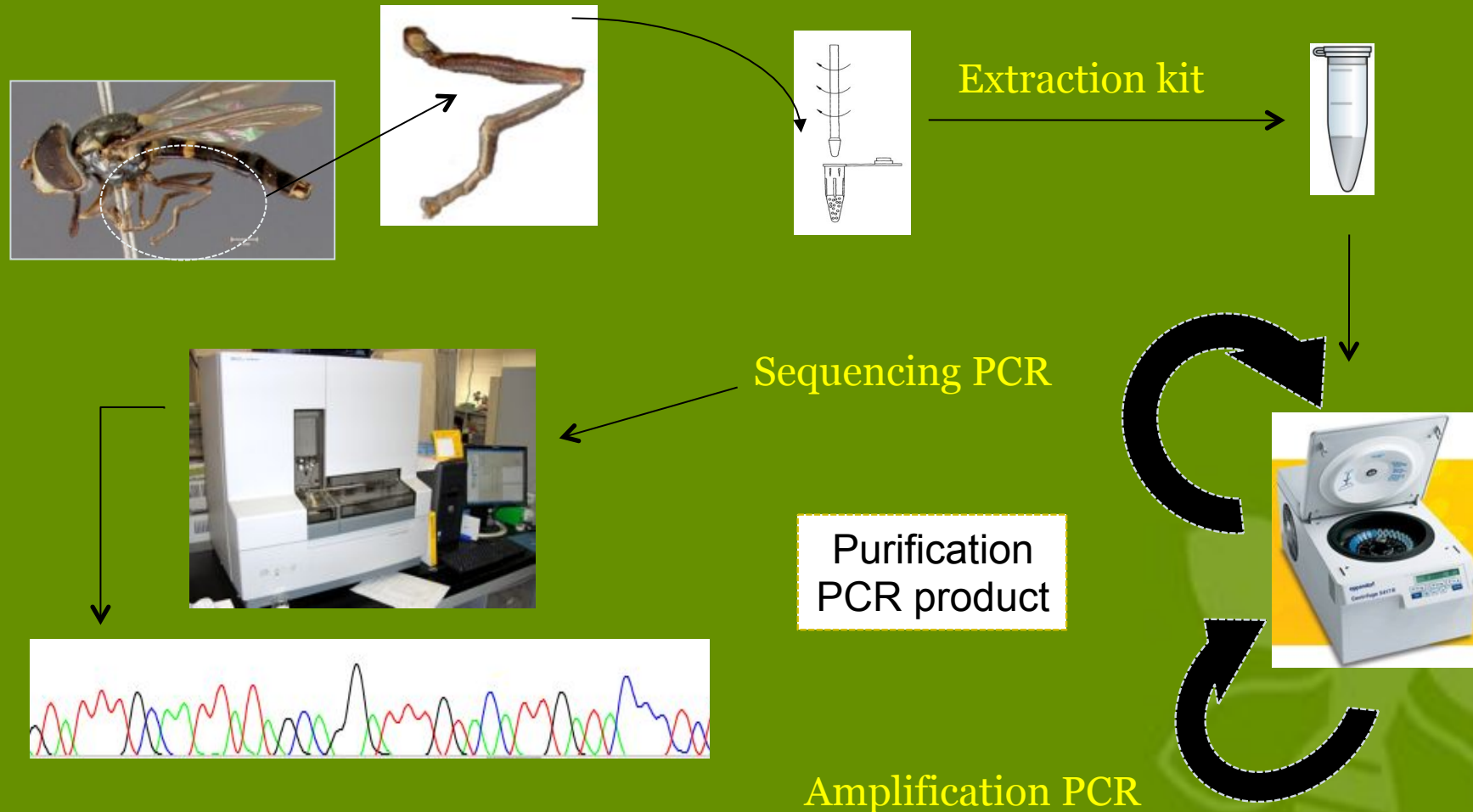


# ECODIPTERA project



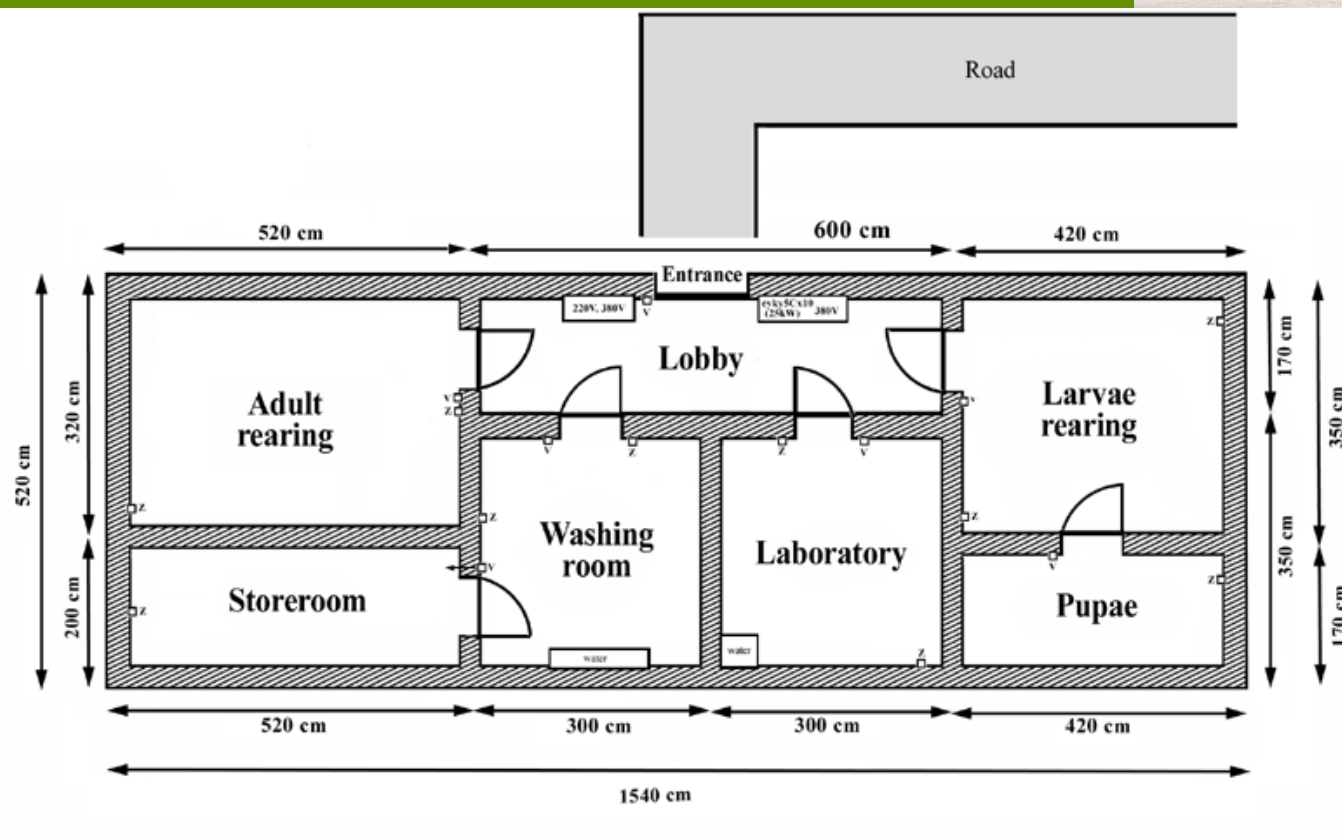
Mass rearing focused on biodegradation & by-product -> fertilizer

## Molecular & morphological characterization of flies





## Pilot plant in Slovakia (integrated system)



## Adult rearing in pilot plant



## Larvae rearing in pilot plant







## Pilot plant in Spain (egg mass-production)



## Pilot plant in Spain (egg mass-production)



 **Ecodiptera**  
*Life*





SELECTION  
OF THE SPECIES

*Musca domestica*

SELECTION  
OF THE STRAIN

IMPROVEMENTS IN  
EGG PRODUCTION

IMPROVEMENTS IN  
BIODEGRADATION  
PROCESS

OPTIMAL:  
-Egg production  
- Reduction of time  
- Quality of individuals

OPTIMAL:  
-Oviposition substrate presentation  
- Adult diet  
- Egg collection period

OPTIMAL:  
-Environmental conditions  
- Larval densities  
- Type of manure  
- Chemical composition

DESIGN OF  
PIG MANURE  
DEGRADING FACILITY

# HERMETIA project



**UNIVERSITY OF ALICANTE (SPAIN)  
FLYSOIL S.L. (PRIVATE COMPANY)**

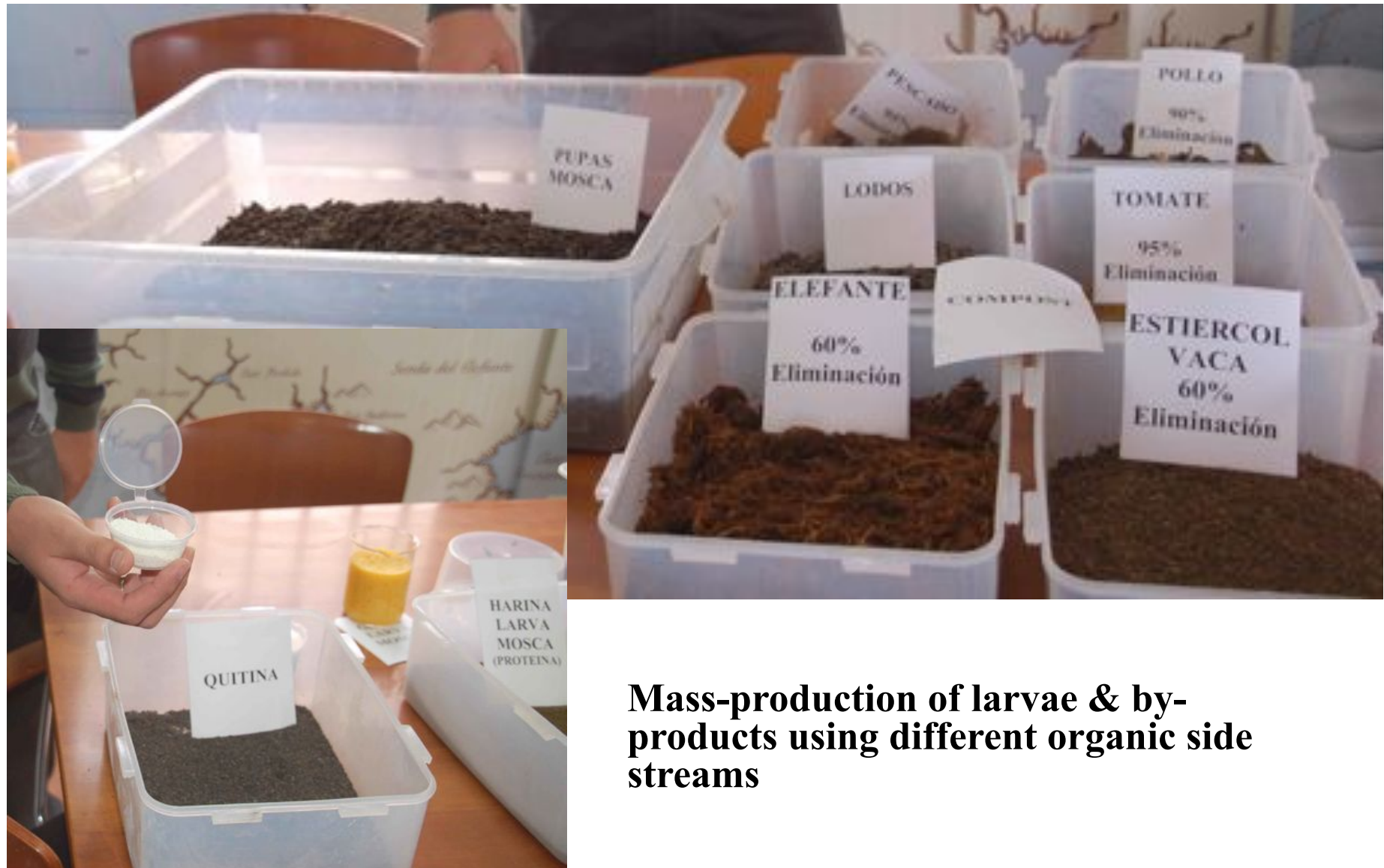
## **GOALS**

**DEVELOPMENT OF INDUSTRIAL LARVAL BIO-DIGESTER  
(FLYSOIL, S.L.)**

**MASS-PRODUCTION OF EGGS TECHNOLOGY  
(UNIVERSITY OF ALICANTE)**

## Organic side streams (fruits/vegetables & meat) and zoological wastes





**Mass-production of larvae & by-products using different organic side streams**



**100-200 kilo/day (larval media)**  
**1-2 million *Hermetia*/day**





# BioFlyTech UA/spin-off



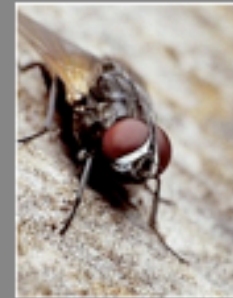
**RESEARCH GROUP “BIONOMY, SYSTEMATICS AND  
APPLIED RESEARCH ON INSECTS”**



**Universitat d'Alacant  
Universidad de Alicante**



2010



# ***BioFlyTech***

**Bioproducts derived from  
Fly mass rearing  
Technology**



**BioFlyTech**  
**01/12/2010**





## Questions & challenges

- Can be fly mass-production timely and cost effective?
- What are the suitable organic side streams to get mass-rearing of flies with feed purposes?
- It is artificial rearing of flies a sustainable technology?
- What are the technical/biological bottlenecks related with fly mass-rearing?
- Insect as feed (whole) or processed?
- Centralized or separate facilities for egg and larval production?
- How many species available?
- It is artificial selection of strains necessary?
- Quality control obligatory but how?



Universitat d'Alacant  
Universidad de Alicante

## BioFlyTech S.L. Spin-off University of Alicante



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