Preliminary results on black soldier fly larvae reared on urban organic waste and sewage sludge

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Outlines

- Introduction
- Aims of the research
- Materials and Methods
- Results
- Discussion and Conclusion

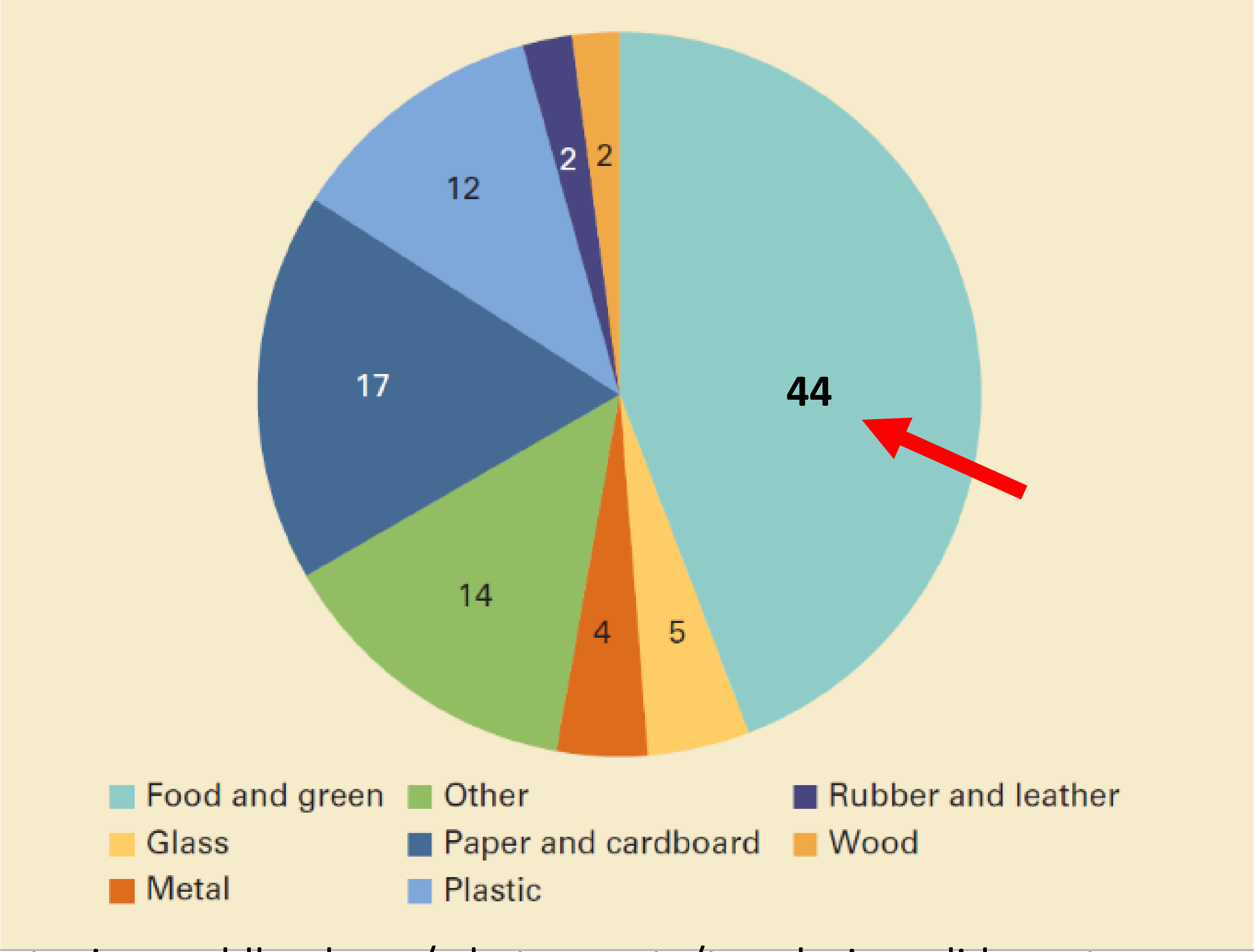
Introduction

Directive 2008/98/EC

«**Organic waste**» biodegradable waste of gardens and parks, food and cooking waste produced by households, restaurants, catering services and retail outlets and similar waste produced by plants of the food industry

Introduction

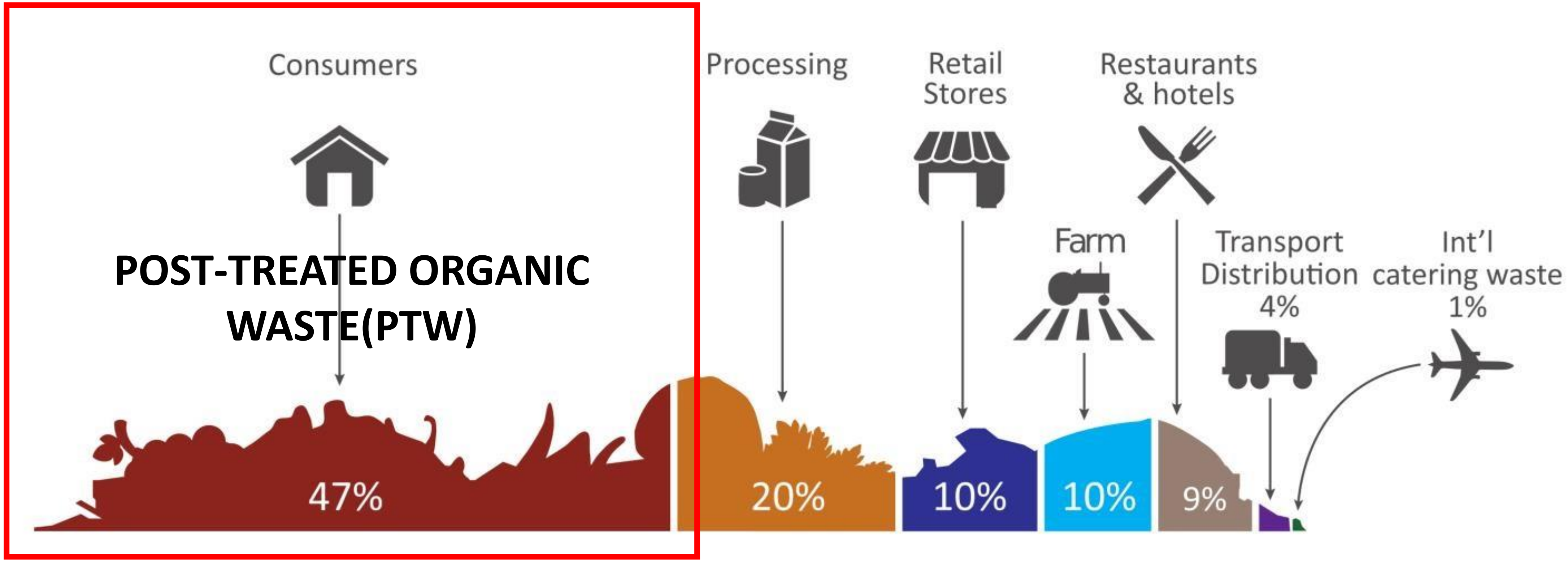
GLOBAL WASTE COMPOSITION (PERCENT)



http://datatopics.worldbank.org/what-a-waste/trends_in_solid_waste_management.html

Introduction

1.6 billion of tons per year of food waste (Jain et al., 2018)



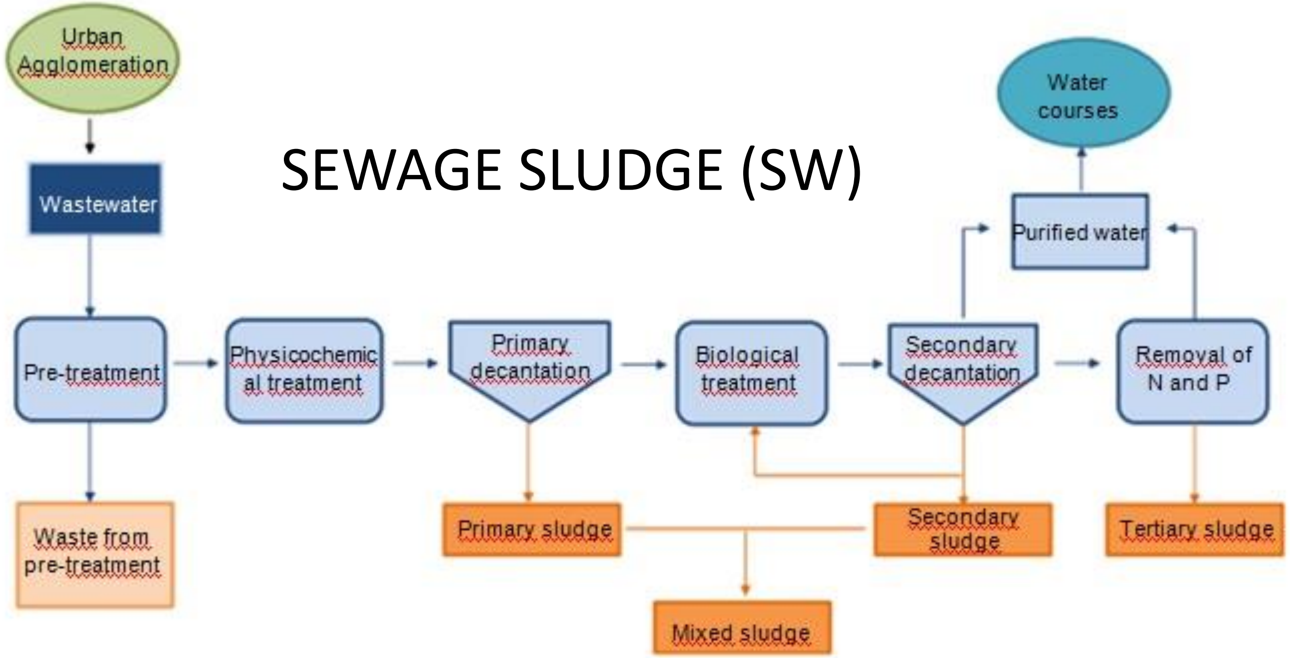
POST-TREATED ORGANIC WASTE(PTW)

https://www.ontario.ca/page/food-and-organic-waste-framework

Introduction

WASTE WATER PRODUCTION

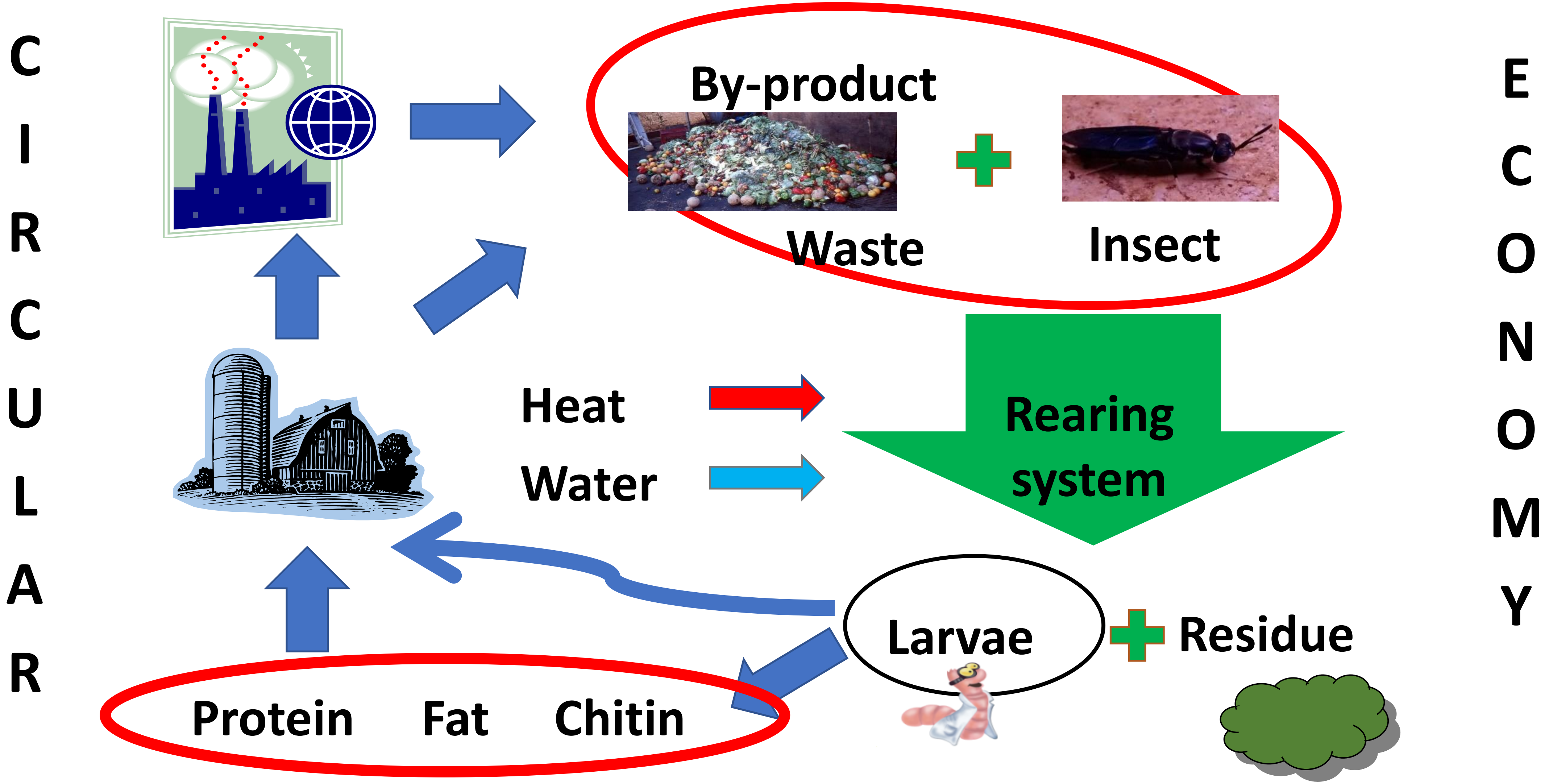
SEWAGE SLUDGE (SW)



330 km^3/year of waste water production around the world (J. Mateo-Sagasta *et al.*, 2015)

Primary sludge: 110-170 gTSS/m^3 of treated wastewater (Tchobanoglous *et al.*, 2003)

Introduction: Black soldier fly



Introduction: Black soldier fly

Substrates: Scavenger Species

(Sheppard et al., 1984)

(Newton et al., 2005)

(Nguyen *et al*, 2015)

(Spranghers *et al*., 2017)

(Meneguz *et al*., 2018)

(Lalander *et al*., 2019)

Aims of the research

- Evaluate PTW and SW combination on BSF development
- Waste reduction of the volume operated by BSF larvae
- Evaluate yogurt waste inclusion and effect on the rearing substrate reduction

Materials and Methods

Post treated waste (PTW)

Plastic separation + grinding

pH: 4.3-4.5

Moisture: ~95%

CP: 24% on DM

EE: 4.4% on DM

Matherials and Methods

Sewage sludge (SW)

pH: 7-8

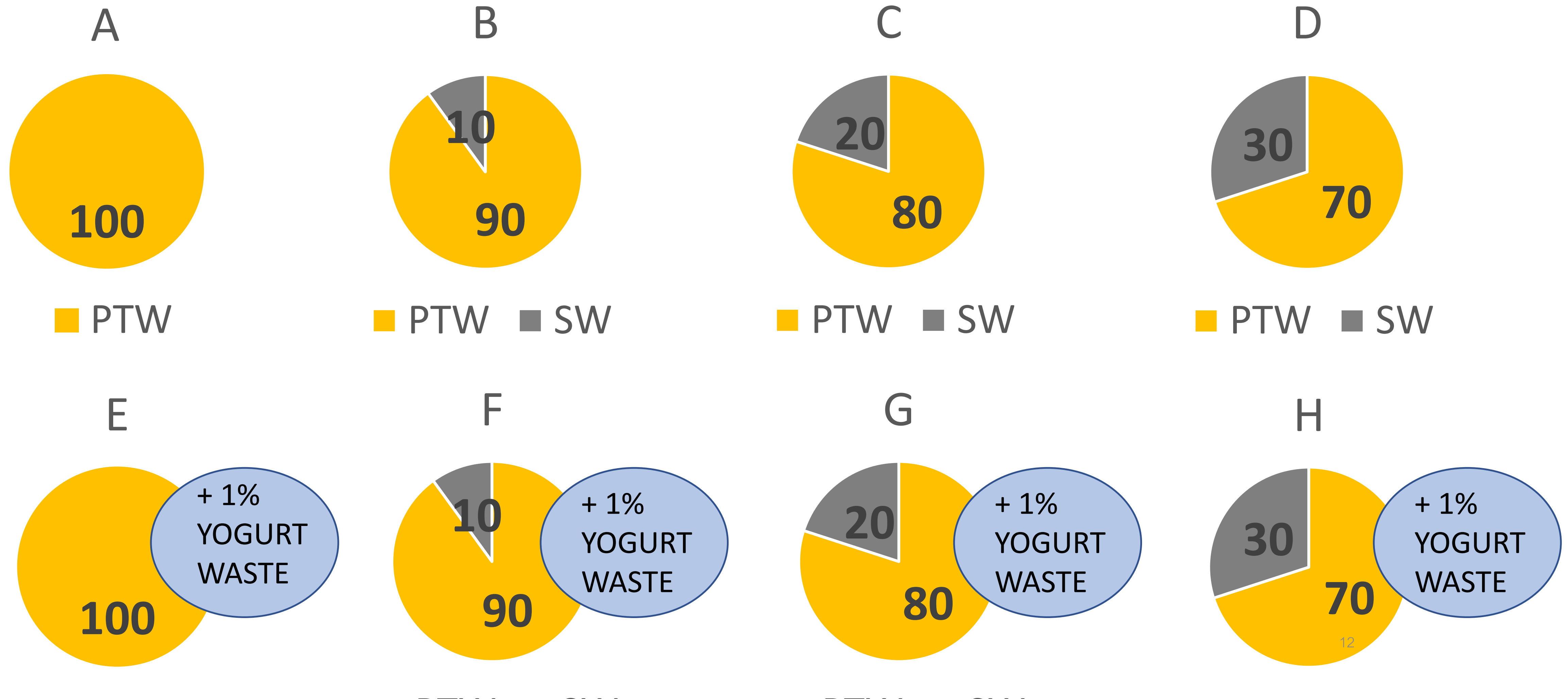
Moisture: 81,1%

CP: 22% on DM

EE: 1.6% on DM

Materials and Methods

Diet formulation:



Materials and Methods

- 6 replicates per treatment
- 2000 larvae of 6 days-old (individual weight: 0.03 ± 0.007 g) per replicate
- 500g of diet at the beginning + as needed

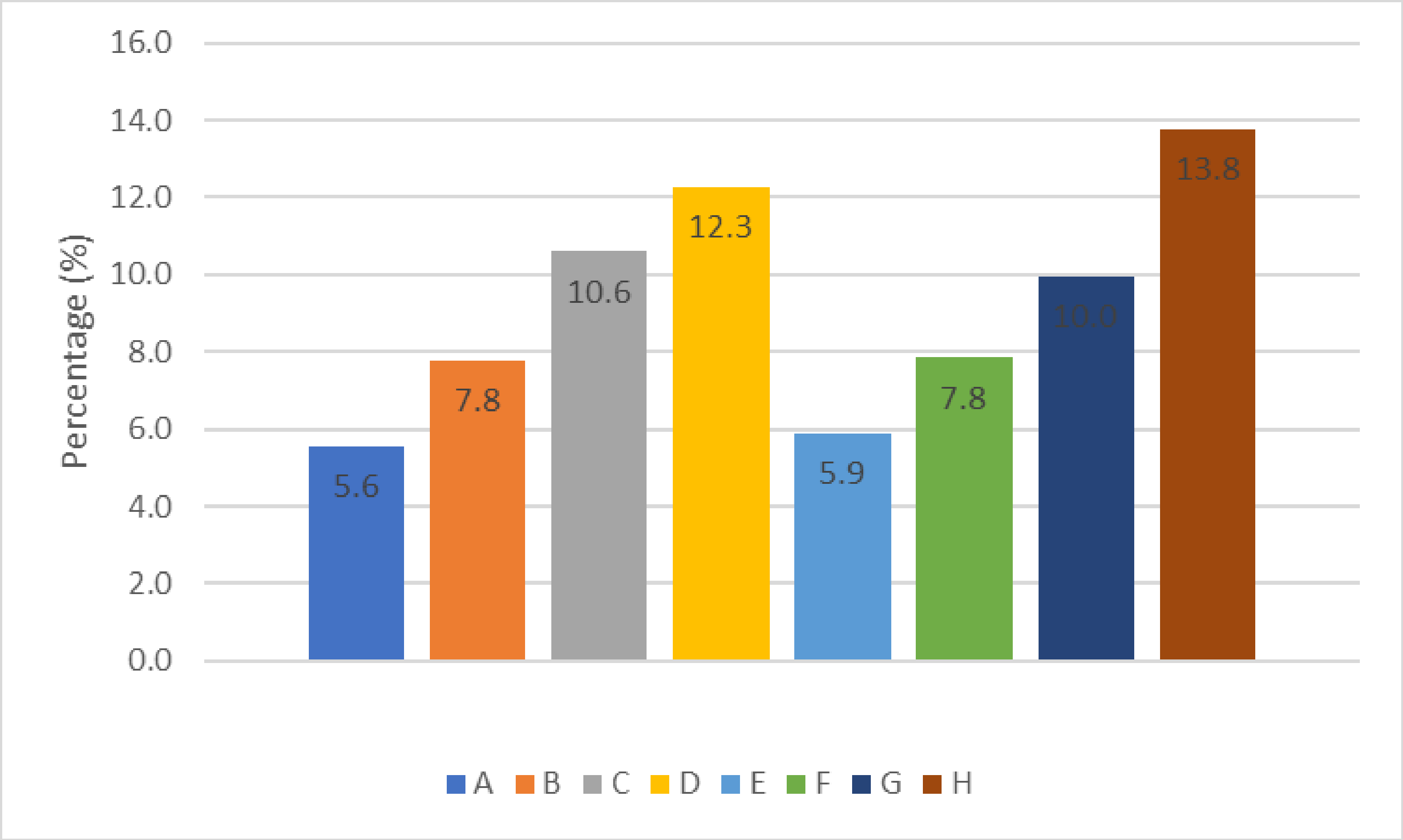
- Evaluation every 4 days of 10 larvae/replicate
- End of the trial: 10 prepupae per replicate
- Evaluation of final weight (FW), final biomass (FB), substrate reduction (SR), WRI, survival rate (SLR)

Materials and Methods

T:27°C; RH: 70%

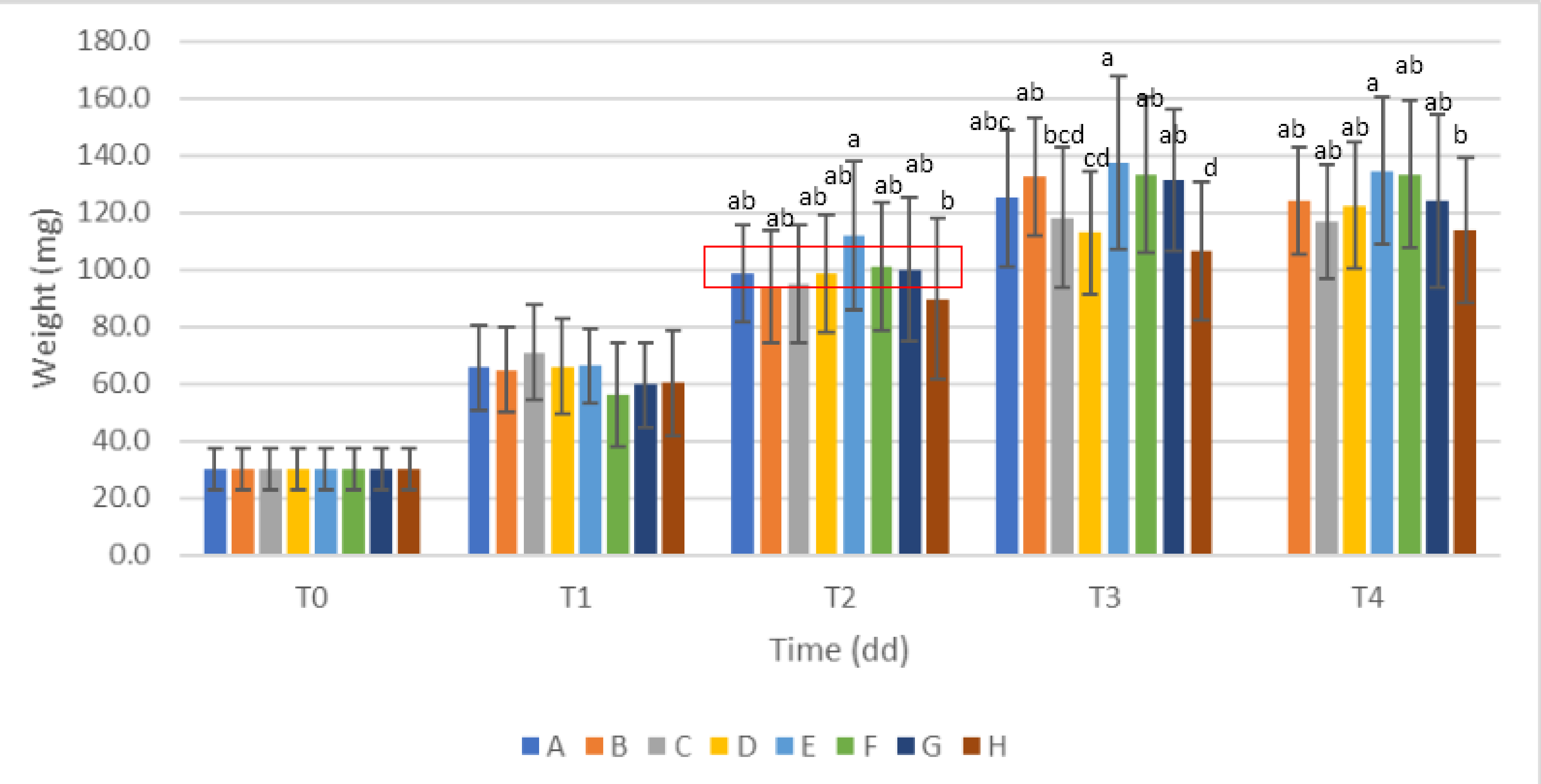
Results

Dry matter of diets



Results

Development of BSF larvae reared on PTW and SW



Results

Treatment	FW (mg)	FB (g)	SLR (%)
A	125.2±5.42ab	125.5±12.27	49.8±5.37ab
B	124.0±6.41ab	123.6±9.91	49.9±6.11ab
C	116.9±8.05ab	138.7±4.39	40.4±5.15b
D	122.6±13.40ab	132.4±13.63	45.7±5.91ab
E	134.7±8.19a	123.7±9.89	53.8±5.77a
F	133.3±12.62ab	138.0±10.61	47.7±7.44ab
G	124.2±17.63ab	127.1±7.61	47.7±9.63ab
H	113.8±11.97b	123.7±9.88	45.3±6.36ab

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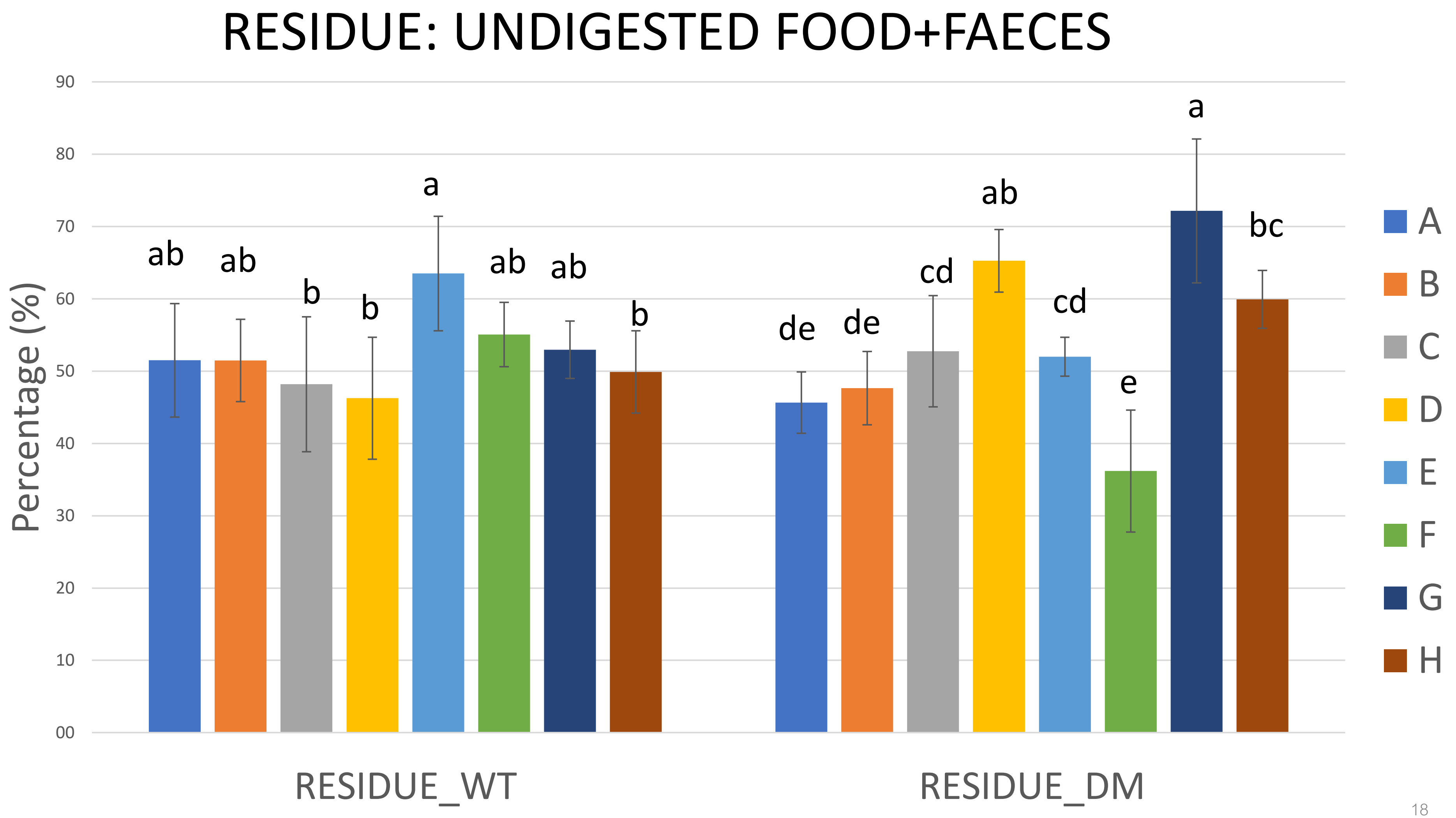
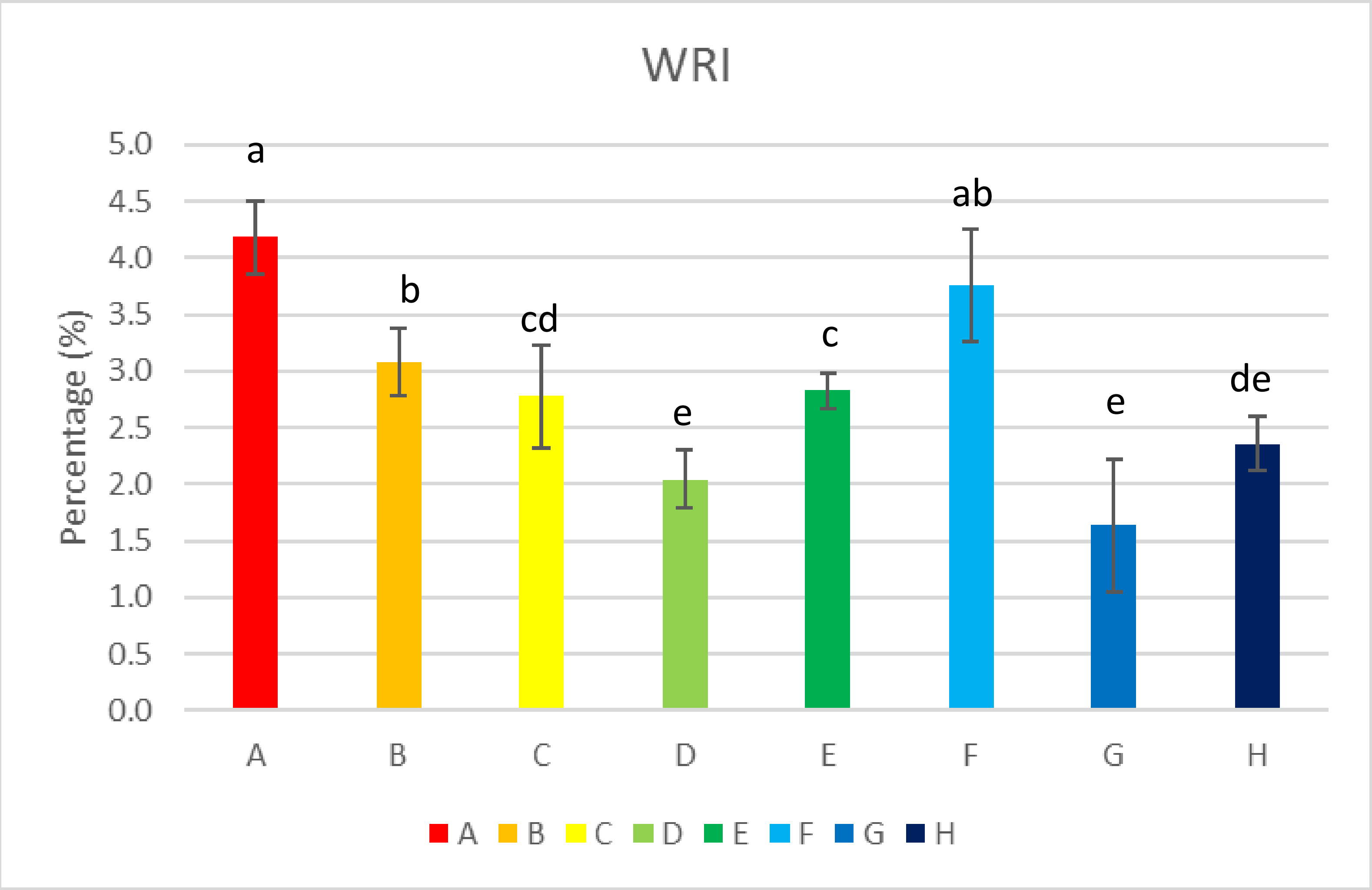
Results



RESIDUE: UNDIGESTED FOOD+FAECES
Percentage (%)
90
80
70
60
50
40
30
20
10
00
ab
ab
b
b
a
ab
ab
b
de
de
cd
ab
cd
e
a
bc
RESIDUE_WT
RESIDUE_DM
A
B
C
D
E
F
G
H

Results



WRI
Percentage (%)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
a
b
cd
e
c
ab
e
de
A
B
C
D
E
F
G
H
A B C D E F G H

Discussion and Conclusion

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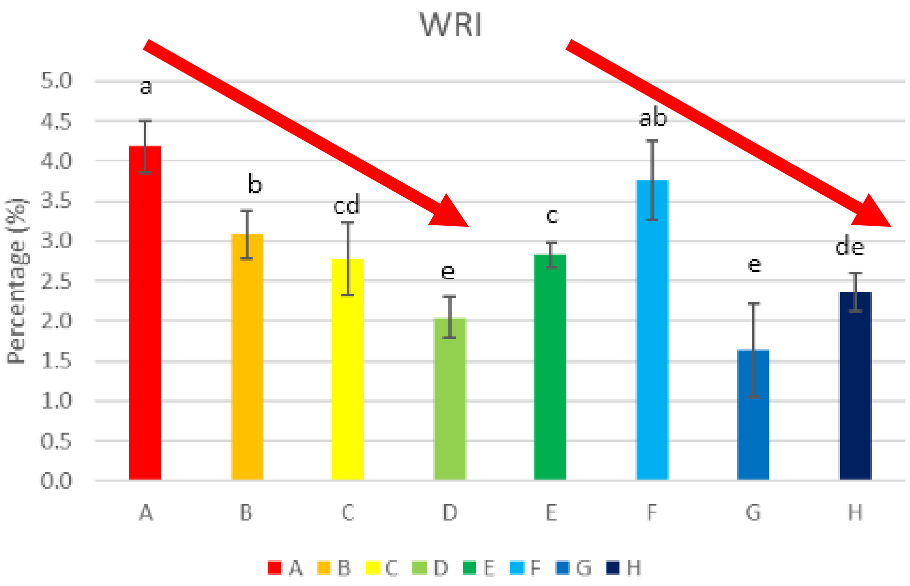
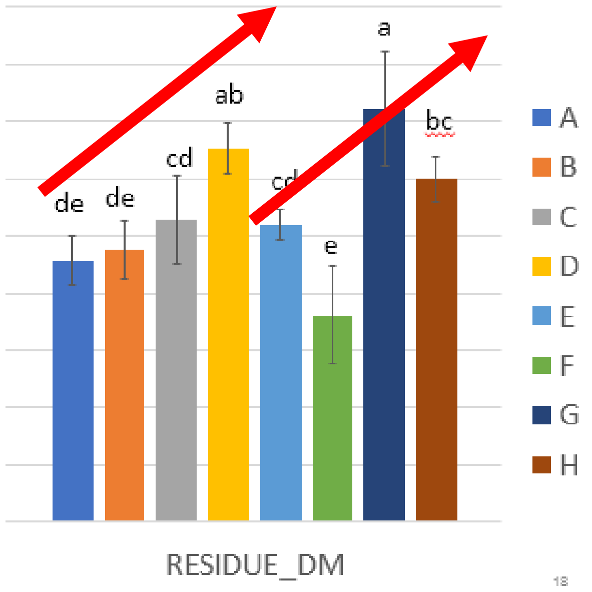
- Inclusion of SW reduce the final weight of BSF (113mg with 30% of SW), (70 mg with 100% digested sludge)(Lalander *et al.,* 2019)
- Inclusion of SW reduce the WRI operated by BSF, but the RESIDUE_DM is higher in SW in higher concentration.





- A part of the SW is not digested by larvae. (ASH of SW: 49.2 % DM)

Discussion and Conclusion

Importance for the reduction of volume of PTW and for waste management of SW!!

A new process to reduce the SW mixing in other waste based diet.

OPTIMUM OF INCLUSION 10% OF SW IN PTW WITH YOGURT WASTE

Improvement:

- Including a straw material to reduce free water in PTW, and reduce mortality (Insecta, 2019)
- To evaluate safety (microbiological of the mix SW+PTW) (Insecta, 2019)
- To evaluate new prebiotic or pretreatment of SW to increase its digestion.
- Use the larvae as BIO-PURIFICATION system of SW, reduce of heavy metal (BSF can accumulate some of them)

Discussion and Conclusion

Legislative Gap:

- Nowadays, it is **IMPOSSIBLE** to feed BSF larvae with PTW and SW considering them as farmed animal

Acknowledgement

THANKS FOR YOUR
KIND ATTENTION