POULTRYNSECT

D 2.4 Report on slaughter performance of intermediate and slow growing poultry breeds

Deliverable 2.4

Achille Schiavone, WP2 Leader

University of Turin, Italy

This project has received funding from transnational funding bodies, partners of the H2020 ERA-NETs SUSFOOD2 and CORE Organic Cofund, under the Joint SUSFOOD2/CORE Organic Call 2019. This document reflects only the author's view and the transnational funding bodies are not responsible for any use that may be made of the information it contains.

Abbreviations	
BS	Bianca di Saluzzo
BSF	Black Soldier Fly
CC	Cold Carcass
CF	Crude Fat
CP	Crude Protein
LW	Live Weight
RTCC	Ready to cook carcass
SW	Slaughtering weight
WP	Work Package

Content

1. Introduction.....4

2. First poultry trial 6

- 2.1 Material and methods.....7
- 2.2 Preliminary Results and Discussion.....8

3. Second poultry trial.....10

- 3.1 Material and methods.....11
- 3.2 First slaughtering age (150 days) Preliminary results and discussion.....12
- 3.3 Second slaughtering age (180 days) Preliminary results and discussion.....13

4. References.....14

Introduction

1. Introduction

The POULTRYNSECT Work Package 2 *"Chickens in vivo feeding trials"* aims to evaluate the Black Soldier Fly (BSF) live larvae inclusion as feed ingredient in chicken diet to reduce the feed soybean content and therefore increase sustainability of poultry production. Animal welfare and environment issues frequently influence the consumer choices in terms of meat purchase (1; 2; 3). Therefore, considering that the use of soybean – which is the main feed ingredient in poultry diet – is nowadays critical for its unsustainability (4), the search for alternative protein sources and rearing systems is fundamental (5). Insects as the BSF could be an alternative to soybean, thanks to their nutritional profile, high feed conversion ratios and lowgreenhouse gases emission (6; 7; 8; 9). Some studies have already been conducted in laying hens, broilers and other avian species fed live insects evaluating the effects on birds' growth, health status and slaughtering performance (5; 6; 10; 11). However, no data are available about the BSF live larvae provision in medium-growing chicken breeds.

The WP2 has three different objectives:

1) perform in vivo poultry feeding trial to determine the optimal inclusion level of live HI larvae for organic chicken production;

2) assess the gender effect on performances, welfare and health of birds fed live insect larvae;

3) assess in two different genotypes model (with different growing-rate) the effect on performances, welfare and health of birds fed live insect larvae.

This Deliverable reports the slaughter performances preliminary results obtained from the first and second *in vivo* trials performed on Label Naked Neck and Bianca di Saluzzo chickens respectively, by the UNITO project partner. For the first trial, males and females of Label Naked Neck hybrids (LLN), a medium-growing genotype, were reared for 82 days of age.
The for the second trial, males of Bianca di Saluzzo (BS) breed (slow-growing genotype) were reared for 150 and 180 days. The choice of focusing only on males was made due to the predisposition of BS males to have higher slaughter yields than females, as stated by Bongiorno *et al*., (2022).
Slaughter performances were recorded on the same day and 24-hour after the slaughter, to determine: Slaughtering Weight (SW), Ready-to-cook carcass weight (RTCCw), Organs weight (heart, spleen, bursa of Fabricius (BF), liver, gut, and stomachs), Cold carcass weight (CCw) after 24h refrigeration, Carcass (%SW), thigh and breast yields (%CCw) of the birds. Samples of breast will be collected to perform the evaluations described in Task 3.3 and 3.4. Samples of small and large intestine are collected and used for the analyses planned in Task 3.5.

First Poultry trial

2.1 Material and Methods

A total of 240 twenty-day-old Label naked neck chicks (Fig. 1) were distributed in four experimental groups according to gender and treatment (10 chickens/pen, 60 birds/treatment):

Figure 1. Females and Males of Label Naked Neck

Figure 2. Slaughter performance evaluation

1. Males fed basal organic feed (CM);
2. Males fed basal organic feed +10% BSF supplementation (LM);
3. Females fed basal organic feed (CF);
4. Females fed basal organic feed +10% BSF supplementation (LF)

According to the average final LW in each pen, 12 birds/treatment (2 birds/pen) were selected for the slaughter performance evaluation on the 82nd day of age.
The following parameters were assessed on each animal:

- Ready-to-cook carcass weight (RTCCw),
- Organs weight → relative weight (RW) calculation (%SW) of the heart, spleen, bursa of Fabricius (BF), liver, gut, and stomachs,
- Cold carcass weight (CCw) after 24h refrigeration,
- Carcass (%SW), thigh and breast yields (%CCw)

2.2 Preliminary results and discussion

Slaughter performances were influenced by the gender, with males (M) being heavier than the females (F) ($P < 0.001$).
Regarding each specific parameter, no differences were observed in the CC yield (%LW) or in the RTCC yield (%LW) between the treated and the control (C) groups, or in the RTCC yield (%LW). A trend was recorded for the gender, with the M tending to display a higher CC yield than the F ($P = 0.091$). The breast yield (%CC weight) was higher in the F than in the M ($P < 0.001$). On the other hand, the M showed a better thigh yield (%CC weight) than the F ($P < 0.001$).
Regarding organ weights, C groups showed a lower relative weight of the spleen (%SW) than the supplemented ones ($P < 0.01$). A statistical trend of the relative weight of the liver (%SW) was observed for gender and tended to be greater in the F than in the M ($P = 0.087$).
The interaction between diet and gender had a significant impact on the relative weight of the bursa of Fabricius (%SW). Specifically, the LF groups displayed a higher relative weight of the bursa of Fabricius than the CF and the LM ones ($P < 0.05$) (Figure 4). The relative weight of the heart (%SW) was higher in the M than in the F ($P = 0.001$). Moreover, the diet tended to affect the relative weight of the heart (% SW), with the C groups which tended to show a lower value than the treated ones ($P = 0.057$).

Tab 1. Slaughtering weight of treated and control groups (P <0,001)

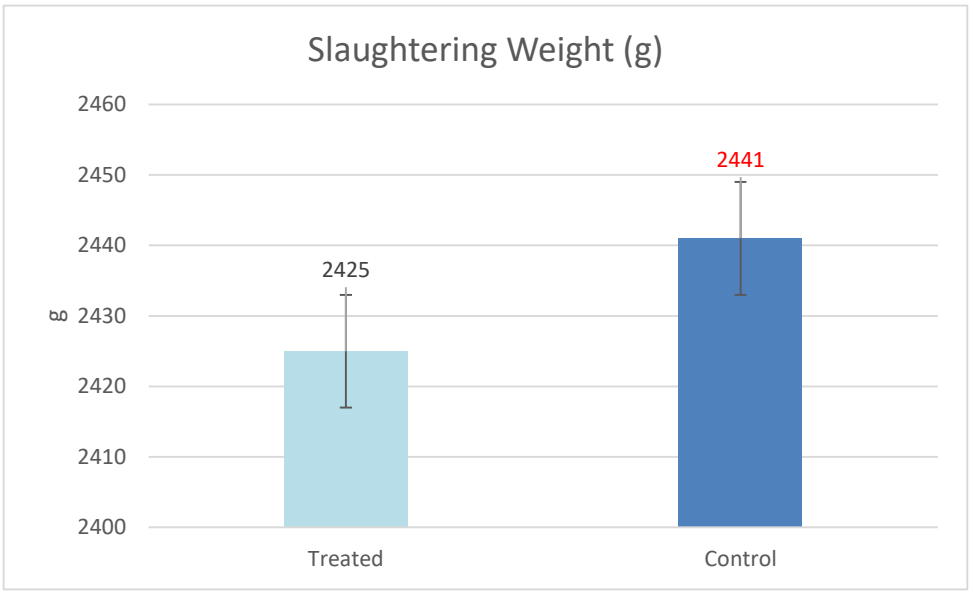
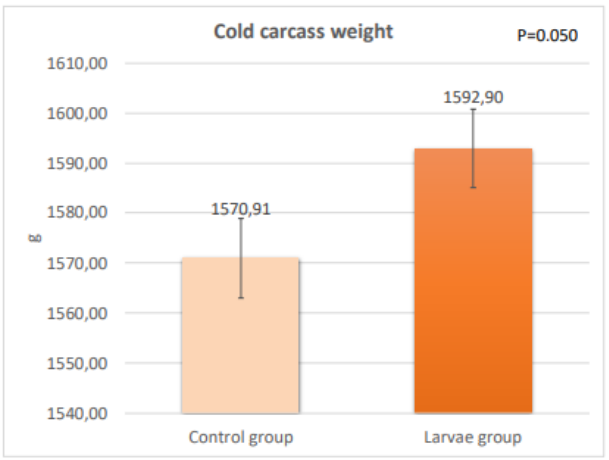


Figure 3. Cold carcass weight and Ready-to-cook carcass weight of treated and control groups



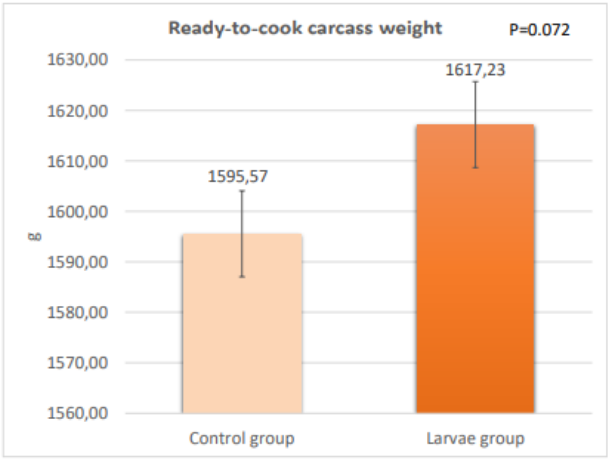


Figure 4. Spleen and Bursa of Fabricius relative weight of treated and control groups

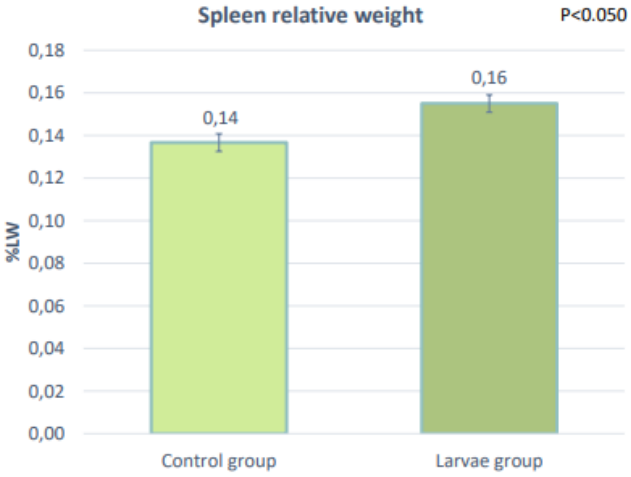
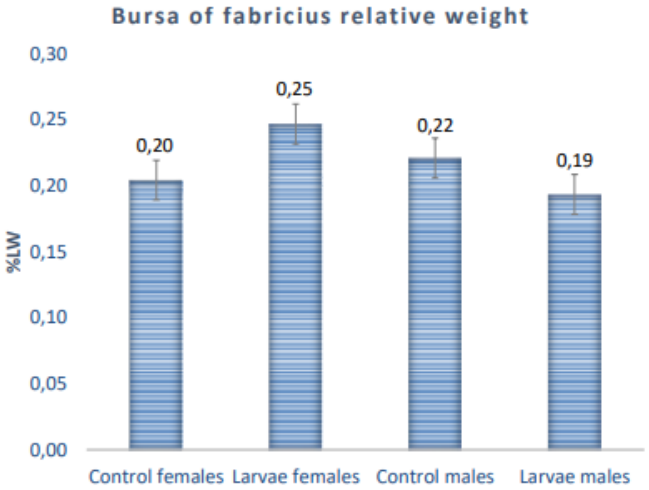


Figure 5. Bursa of Fabricius relative weight in the four dietary treatment



3. Second poultry trial

3.1 Material and Methods

For the second trial, a total of 144 Bianca di Saluzzo male chicks were hatched, reared at the Avian Conservation Centre of Local Genetic Resources of the University of Turin (north-west of Italy) and then selected, at 39 days of age, for the experiment on the basis of the average body weight. The trial was carried out from the end of May until the middle of October. The initial weight of the birds was around 300 g.

Figure 6. Bianca di Saluzzo male chicks

After being selected and randomly distributed between three experimental groups, birds were allotted between 18 pens (8 chicken/pen, 48 birds/treatment):

1. birds fed Commercial feed (C);
2. birds fed Sustainable feed (S);
3. birds fed Sustainable feed +15% Live BSF Larvae supplementation (SLL).

Feed and water were provided ad libitum (COMMERCIAL FEED: 18 % CP, 4.1% CF and SUSTAINABLE FEED: 18,2% CP, 4% CF) (Mangimi Monge di Monge Antonio e C. Snc). The commercial feed and the sustainable one were respectively, as it follows, mainly composed by:

1. Commercial feed: corn meal, soybean meal, soybean oil
2. Sustainable feed: corn meal, corn gluten, field bean, pea protein, sunflower flour, barley flour

In addition, based on their Daily Feed Intake, SLL experimental group received a 15% supplementation of live BSF larvae.
Natural ventilation and photoperiod (from 15L:9D in May, to 12L:12D in October) were applied for the entire experiment. Outdoor access was granted to the chickens from 49 days of age until the end of the trial. Health status of the birds was checked daily and the mortality recorded.

For this trial animals were split into two different slaughtering ages, 150 and 180 days.
For each slaughtering age, 12 birds/treatment (2 birds/pen) were selected for the slaughter performances evaluation, according to the average final LW of each pen. The following parameters were assessed on each animal:

- Ready-to-cook carcass weight (RTCCw),
- Organs weight → relative weight (RW) calculation (%SW) of the heart, spleen, liver, gut, and stomachs
- Cold carcass weight (CCw) after 24h refrigeration
- Carcass (%SW), thigh and breast yields (%CCw)

3.2 Preliminary results and discussion (first slaughtering age: 150 gg)

Due to feed similarities, the following preliminary results comprehend just the differences found between the Sustainable + 15% Live Larvae- fed (SLL) and Sustainable-fed (S) groups.
Slaughter performances were mainly influenced by the slaughtering age, with SLL animals being significantly heavier than the S group (P< 0,05) **(Fig. 7)**.
Regarding each specific slaughtering parameter, no significant differences were observed for Ready-to-cook carcass weight (RTCCw), Cold carcass weight (CCw) after 24h refrigeration, thigh and breast yields (%CCw).
Concerning organs relative weight (%SW), no differences were found between treatments, except for the glandular stomach, being significantly heavier in the SLL group than in S group (**Fig. 8**).

Figure 7. Slaughtering Weight of Larvae and Sustainable fed groups at 150 days of age

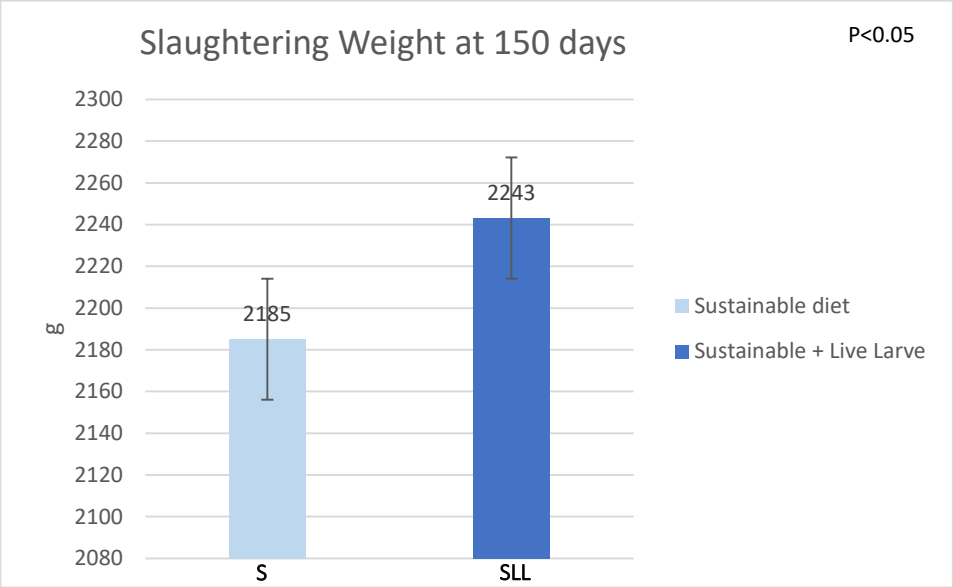
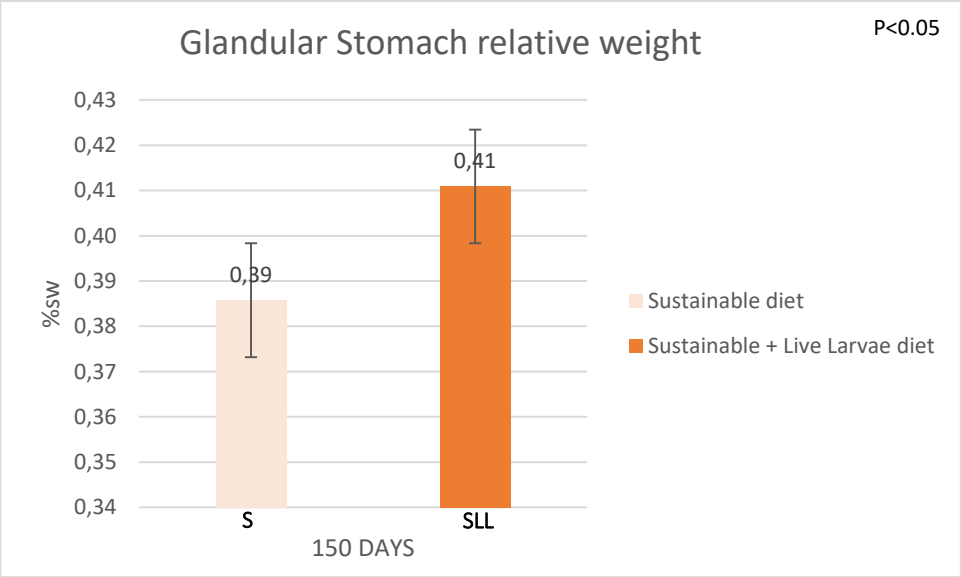


Figure 8. Glandular stomach relative weight at 150 days of age of the two experimental groups (%SW)



3.3. Preliminary results and discussion (2nd slaughtering age: 180 gg)

Slaughter performances at 180 days of age were mainly influenced by the slaughtering age too, with 180-days old live larvae-fed animals still heavier than S fed animals **(Fig. 9)** (P< 0,05). Again, the glandular stomach relative weight was the only significantly different parameter found between the two treatments and was heavier in SLL group than in S group (Fig.10).

Figure 9. Slaughtering Weight of the two dietary treatments at 180 days of age

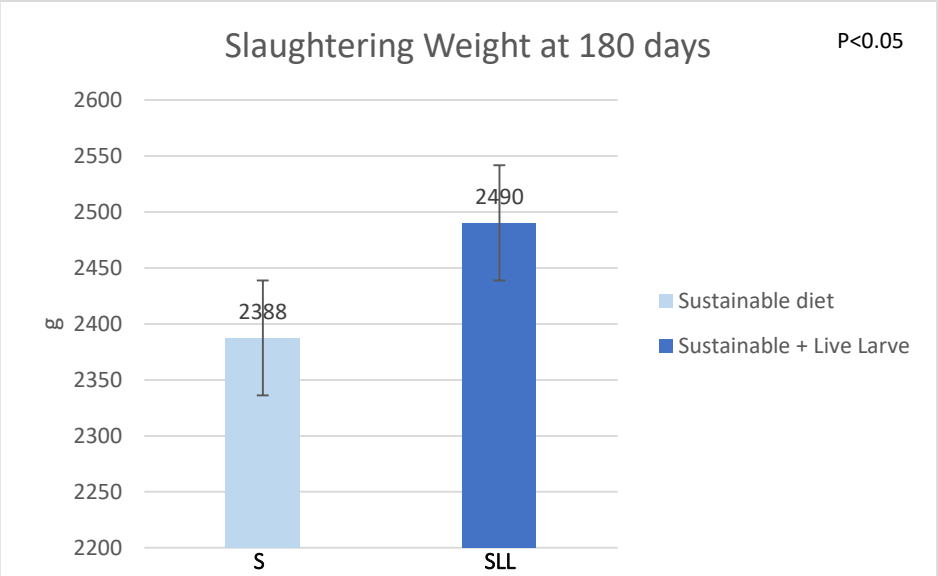
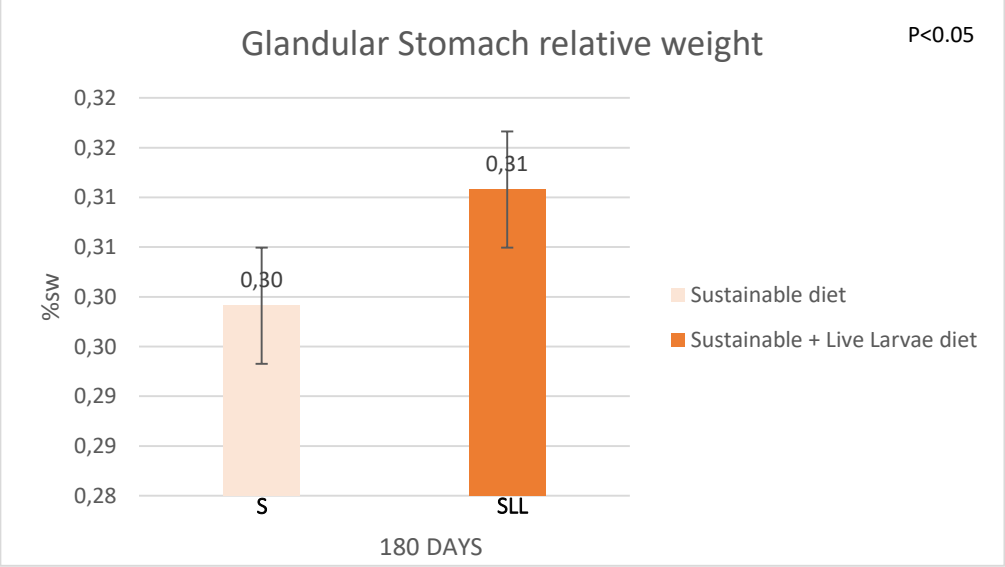


Figure 10. Glandular stomach relative weight amongst treatments at 180 days of age (%SW)



References

References:

1. Bongiorno V., Schiavone A., Renna M., Sartore S., Soglia D., Sacchi P., Gariglio M., Castillo A., Mugnai C., Forte C., Bianchi C., Mioletti S., Gasco L., Biasato I., Brugiapaglia A., Sirri F., Zampiga M., Gai F., Marzoni M., Cerolini S., Dabbou S. (2022). Carcass Yields and Meat Composition of Male and Female Italian Slow-Growing Chicken Breeds: Bianca di Saluzzo and Bionda Piemontese. Animals. 12(3):406.

2. Castellini C., Berri C., Le Bihan-Duval E. and Martino G. (2008). Qualitative attributes and consumer perception of organic and free-range poultry meat, World's Poultry Science Journal. 64, 500-512.

3. Devatkal S. K., Naveena B. M. and Kotaiah T. (2019). Quality, composition, and consumer evaluation of meat from slow-growing broilers relative to commercial broilers. Poultry Science. 98, 6177-6186.

4. Pinto Da Rosa P., Pio Ávila B., Damé Veber Angelo I., Garavaglia Chesini R., Albandes Fernandes T., Da Silva Camacho J., Bugoni M., Roll V.F.B. and Gularte M.A. (2021). Impact of different chicken meat production systems on consumers' purchase perception. British Poultry Science. Online early view, doi: 10.1080/00071668.2020.1857335.

5. Jia F., Peng S., Green J., Koh L. and Chen X. (2020). Soybean supply chain management and sustainability: A systematic literature review. Journal of Cleaner Production. 255, Online early view, doi: 10.1016/j.jclepro.2020.120254.

6. Soglia D., Sartore S., Maione S., Schiavone A., Dabbou S., Nery J., Zaniboni L., Marelli S., Sacchi P. and Rasero R. (2020). Growth performance analysis of two Iitalian slow-growing chicken breeds: Bianca di Saluzzo and Bionda Piemontese. Animals. 10, article n. 969.

7. Van Huis A. (2013). Potential of Insects as Food and Feed in Assuring Food Security. Annual Review of Entomology. 58, 563-83.

8. Józefiak D., Józefiak A., Kierończyk B. and Rawski M. (2016). Insects - a natural nutrient source for poultry – a review. Annals of Animal Science. 16, 297-313.

9. Allegretti G., Talamini E., Schmidt V., Bogorni P.C., Ortega E. (2017). Insect as feed: An emergy assessment of insect meal as a sustainable protein source for the Brazilian poultry industry. Journal of Cleaner Production. 171, 403-412.

10. Barragan-Fonseca K.B., Dicke M. and van Loon J.J.A. (2017). Nutritional value of the black soldier fly (Hermetia illucens) and its suitability as animal feed – a review. Journal of Insects as Food and Feed. 3(2), 105-120.

11. Bellezza Oddon S., Biasato I., Imarisio A., Pipan M., Dekleva D., Colombino E., Capucchio M.T., Meneguz M., Bergagna S., Barbero R., Gariglio M., Dabbou S., Fiorilla E., Gasco L. and Schiavone A. (2021). Black soldier fly and yellow mealworm live larvae for broiler chickens: Effects on bird performance and health status. J Anim Physiol Anim Nutr. 105: 10-18.

POULTRYNSECT

This project has received funding from transnational funding bodies, partners of the H2020 ERA-NETs SUSFOOD2 and CORE Organic Cofund, under the Joint SUSFOOD2/CORE Organic Call 2019. This document reflects only the author's view and the transnational funding bodies are not responsible for any use that may be made of the information it contains.