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Enhancing Poultry Sustainability: Black Soldier Fly Effects on Laying Hen Welfare and Microbiota

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Agenda

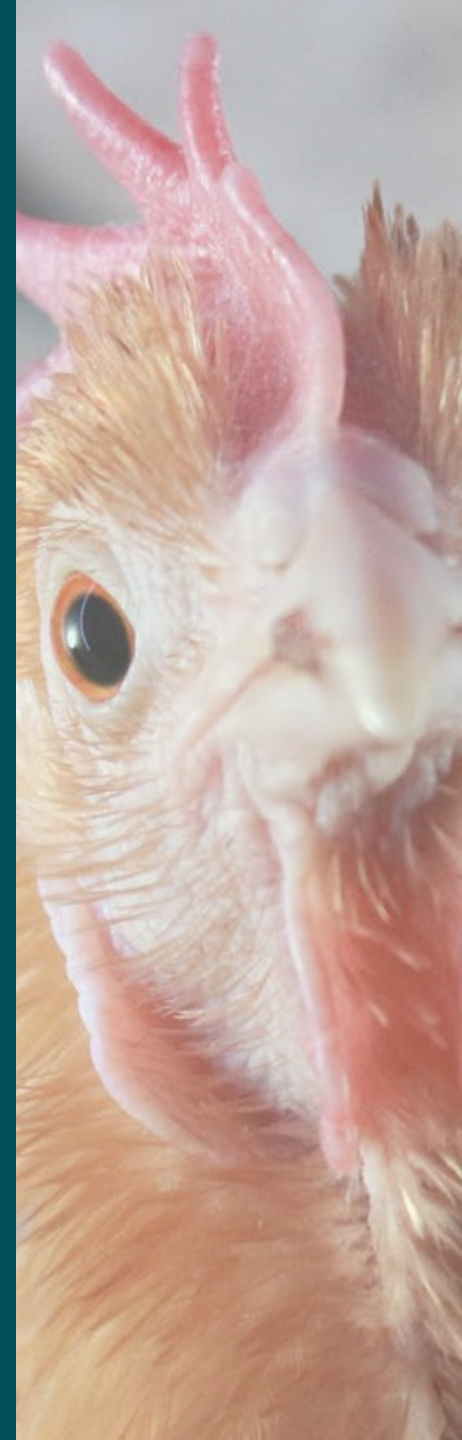
1. Insects and poultry
2. Experimental design
3. Results
 - Hens' welfare
 - Hens' microbiota
4. Conclusions and next steps



1. Insects and poultry

- Birds have been eating insects from the ground since the dawn of time. (Star *et al.*, 2020; Tahamtani *et al.*, 2021).
- Insects are gaining attention as sustainable feed (Barragan-Fonseca *et al.*, 2017).
In particular:

Black soldier fly (BSF, *Hermetia illucens* L.)



1. Insects and poultry

Rich literature

Dried BSF

Laying hens

(Dabbou *et al.*, 2018;
Ruhnke *et al.*, 2018; Bellezza
Oddon *et al.*, 2021; Patterson *et al.*, 2021; Navasero *et al.*, 2022).

BSF meal

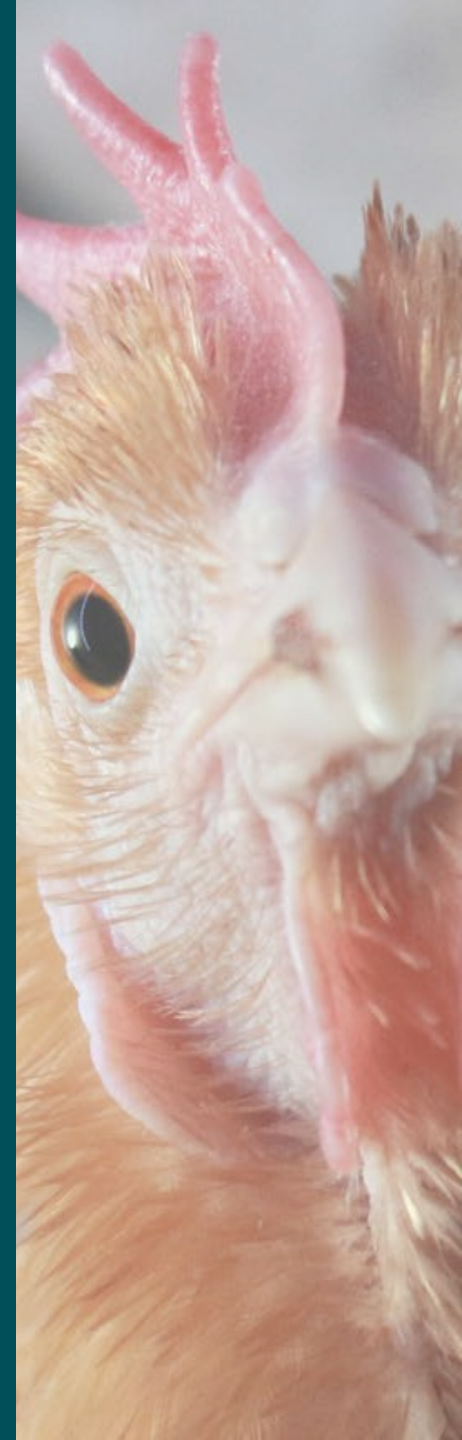
Broilers



RESEARCH GAP

Use of live BSF larvae as poultry feed

Allows birds to maintain their natural pecking behavior

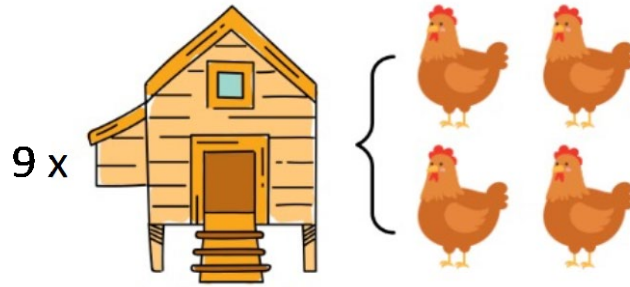


AIM OF THE RESEARCH

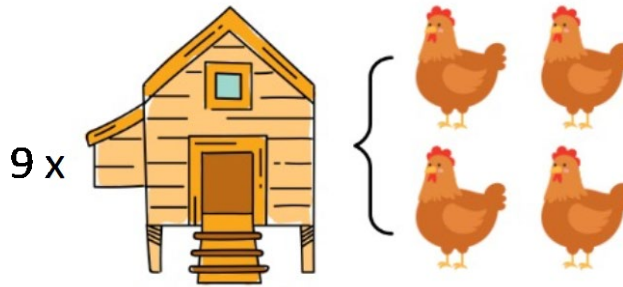
Evaluate BSF live larvae
supplementation
on laying hens
Welfare and Microbiota



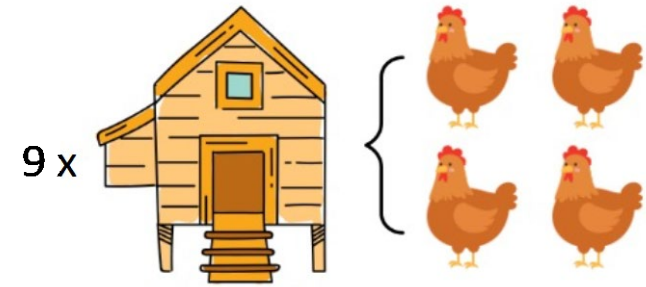
2. Experimental design



BSFL 0 GROUP
36 animals.
Commercial diet.



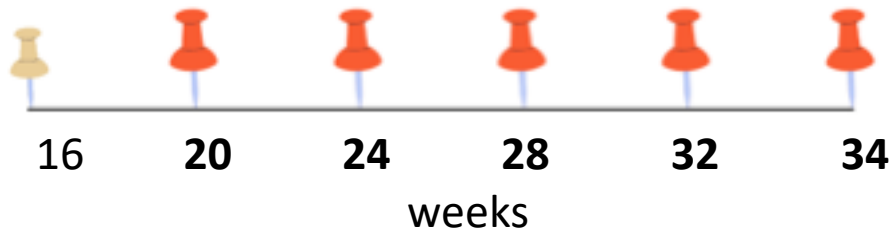
BSFL 15 GROUP
36 animals.
Commercial diet +
15% live BSF on DFI.



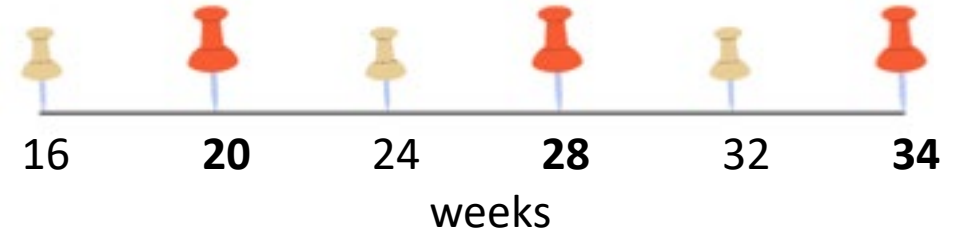
BSFL 30 GROUP
36 animals.
Commercial diet +
30% live BSF on DFI.

108 Lohman Brown hens,
18 weeks of trial (from 16 to 34 weeks of age).

2. Experimental design



- Feathering score
- Excreta corticosterone analysis



- Excreta microbiota analysis



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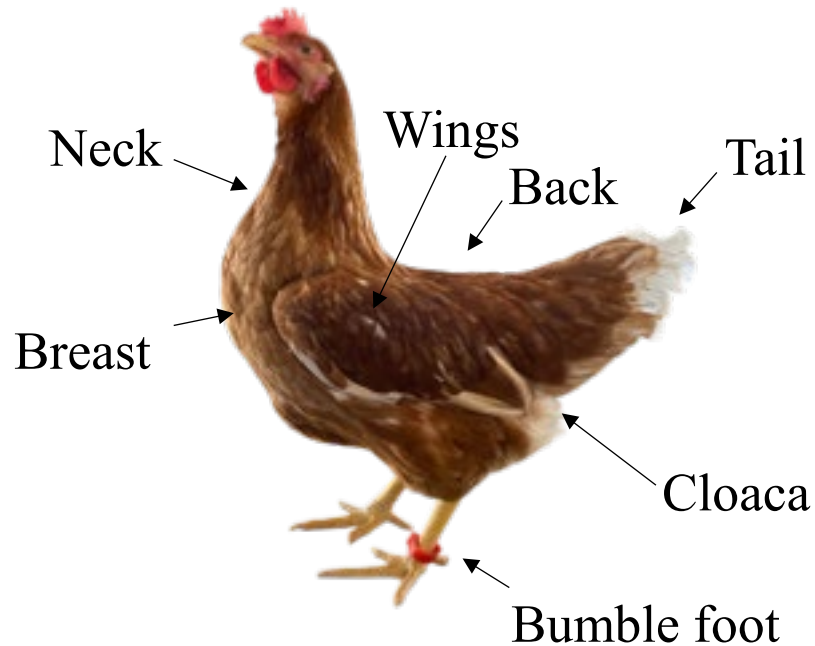


C3A
CENTRO
AGRICOLTURA
ALIMENTI
AMBIENTE



2. Experimental design

- **Feathering score:**



Higher the score is, better the status of the body is.

- **Corticosterone**

Pool of fresh excreta for each cage (n=27)

Multispecies ELISA kit for metabolites corticosterone analysis.

- **Microbiota**

Pool of fresh excreta for each cage (n=27)

16S ribosomal RNA gene (16S rRNA) with a two-step PCR protocol

Statistical analysis:

Linear mixed models, considering the effects of diet, time, and their interaction.

3.Results



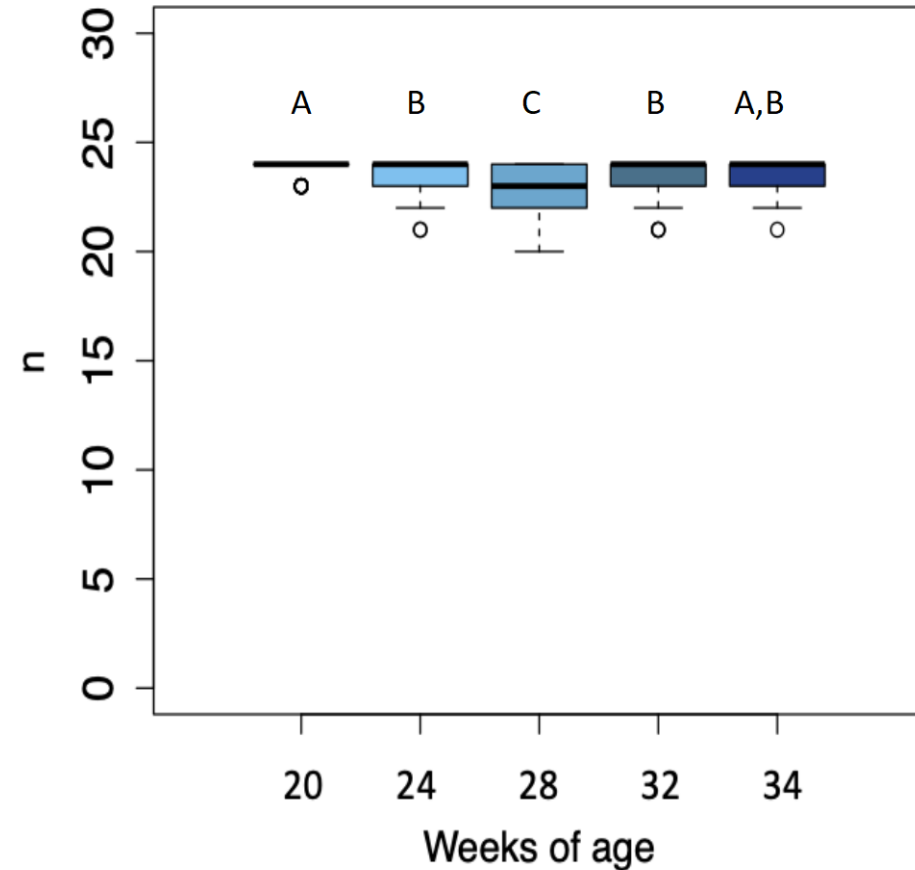
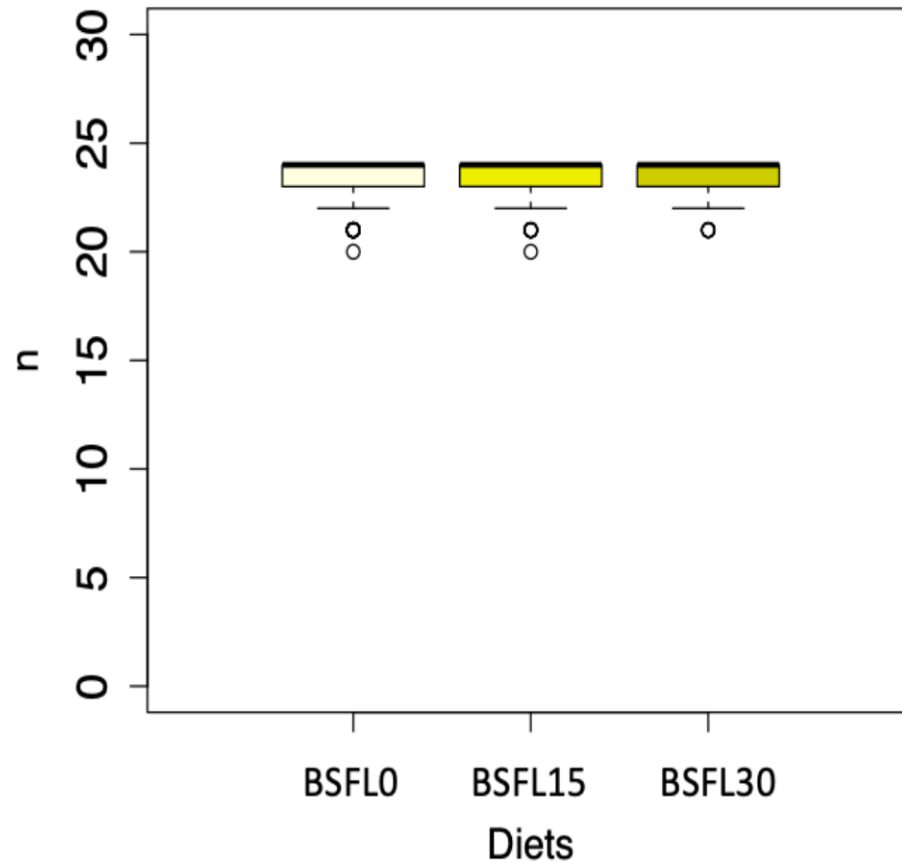
3.1. Hens' welfare

Feathering score:

Diet: non significant

Time: <0.001

Diet*time: non significant



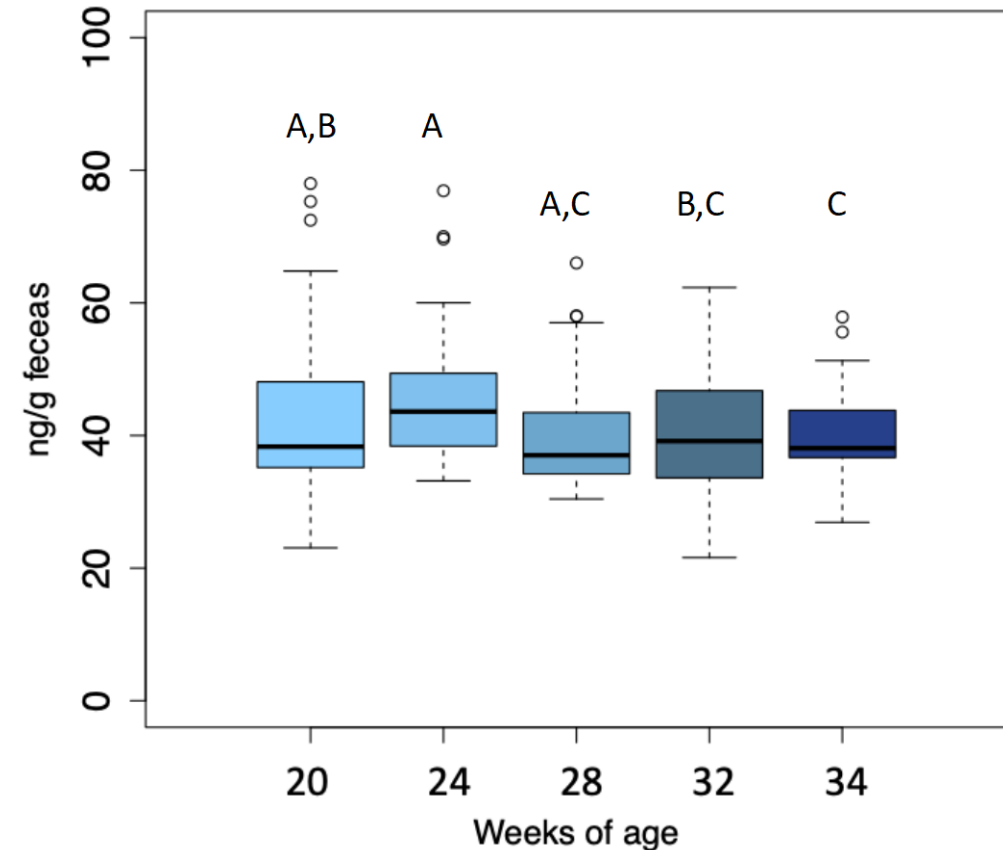
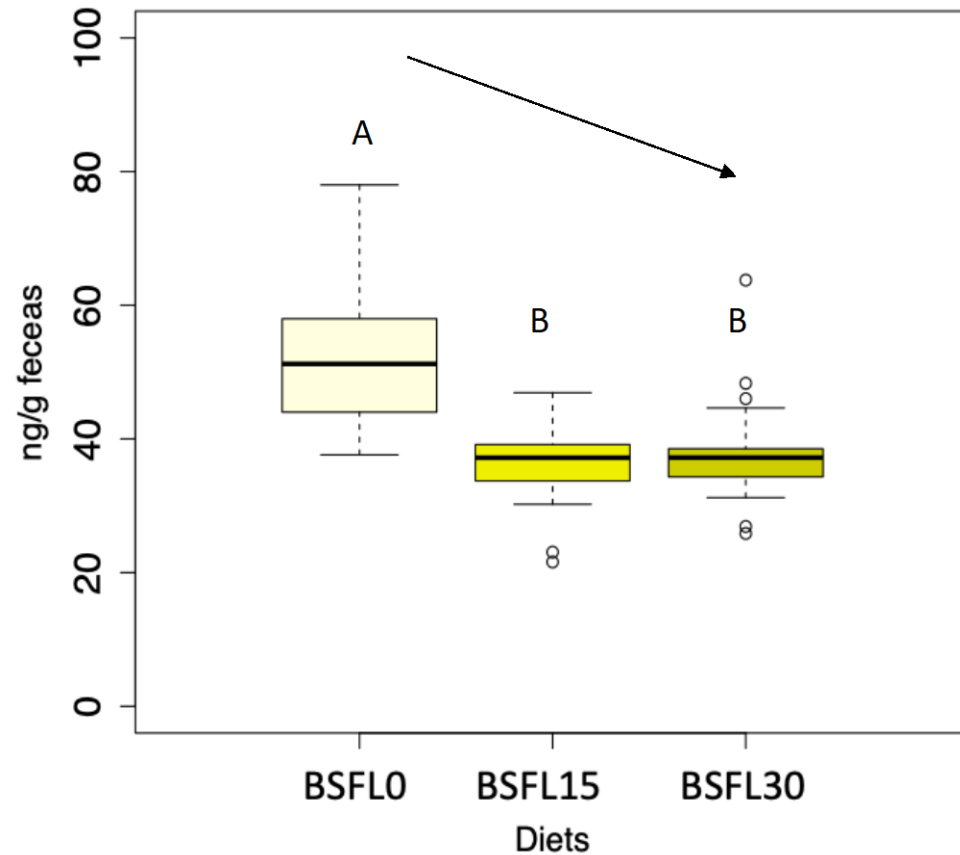
3.2. Hens' welfare

Corticosterone:

Diet: <0.001

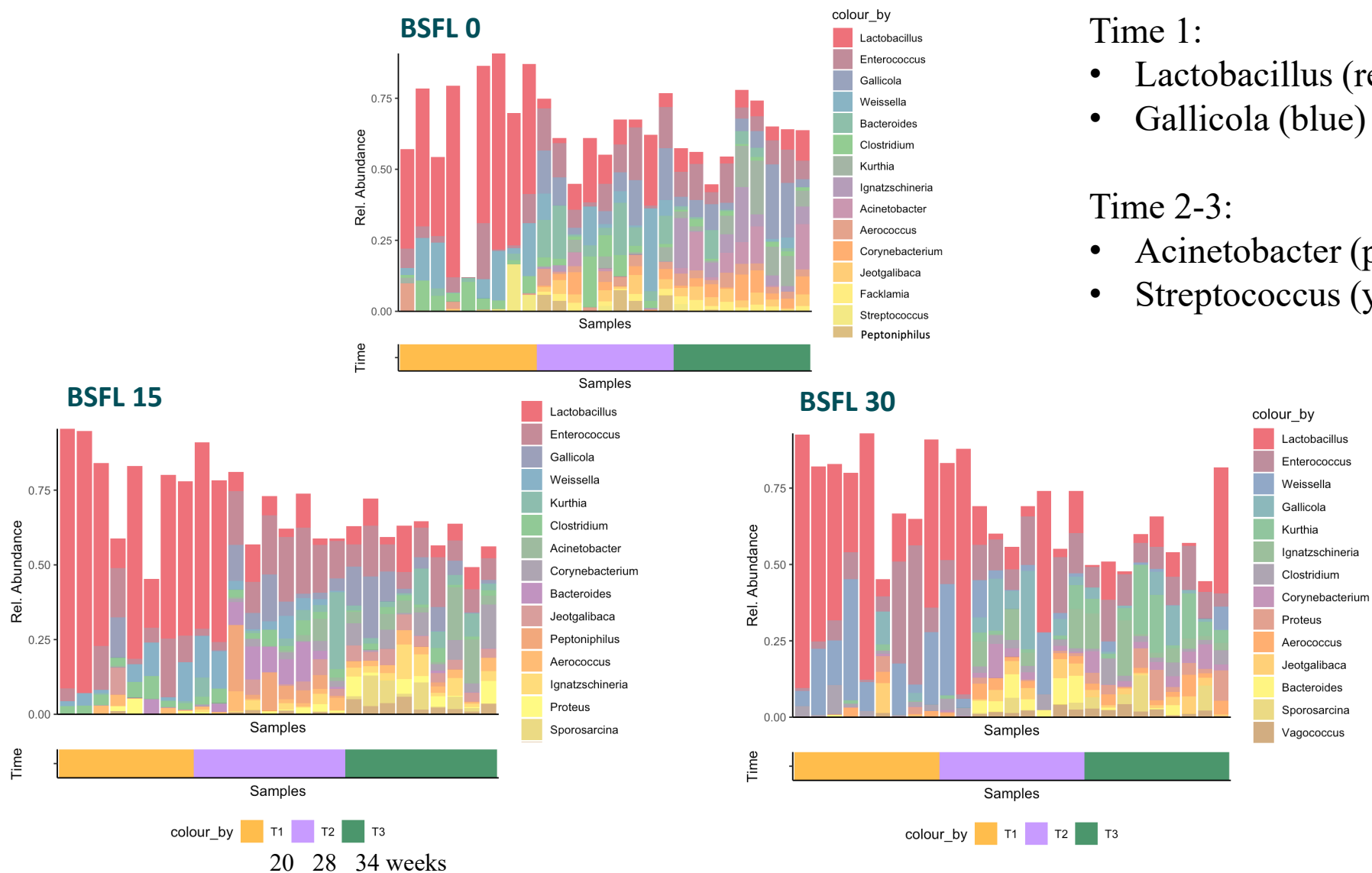
Time: 0.001

Diet*time: 0.058



POSITIVE EFFECT OF LIVE BSF ON HENS' EXCRETA CORTICOSTERONE

3.3. Hens' microbiota - differential abundance (Genus level)



Time 1:

- Lactobacillus (red),
- Gallicola (blue)

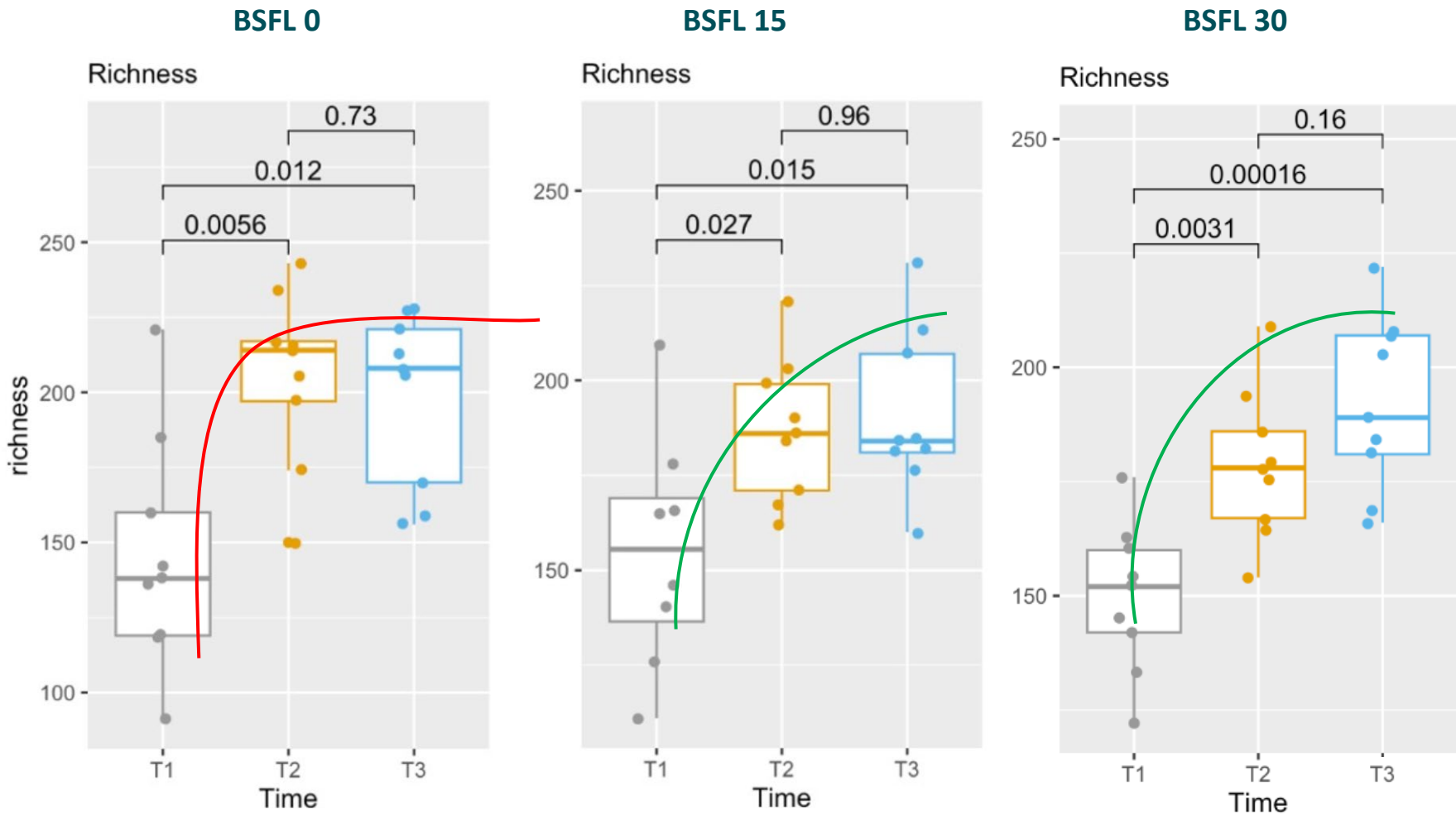
Time 2-3:

- Acinetobacter (purple),
- Streptococcus (yellow)

3.3. Hens' microbiota – Alpha diversity

Biodiversity (number) of species

Time 1 vs 2-3

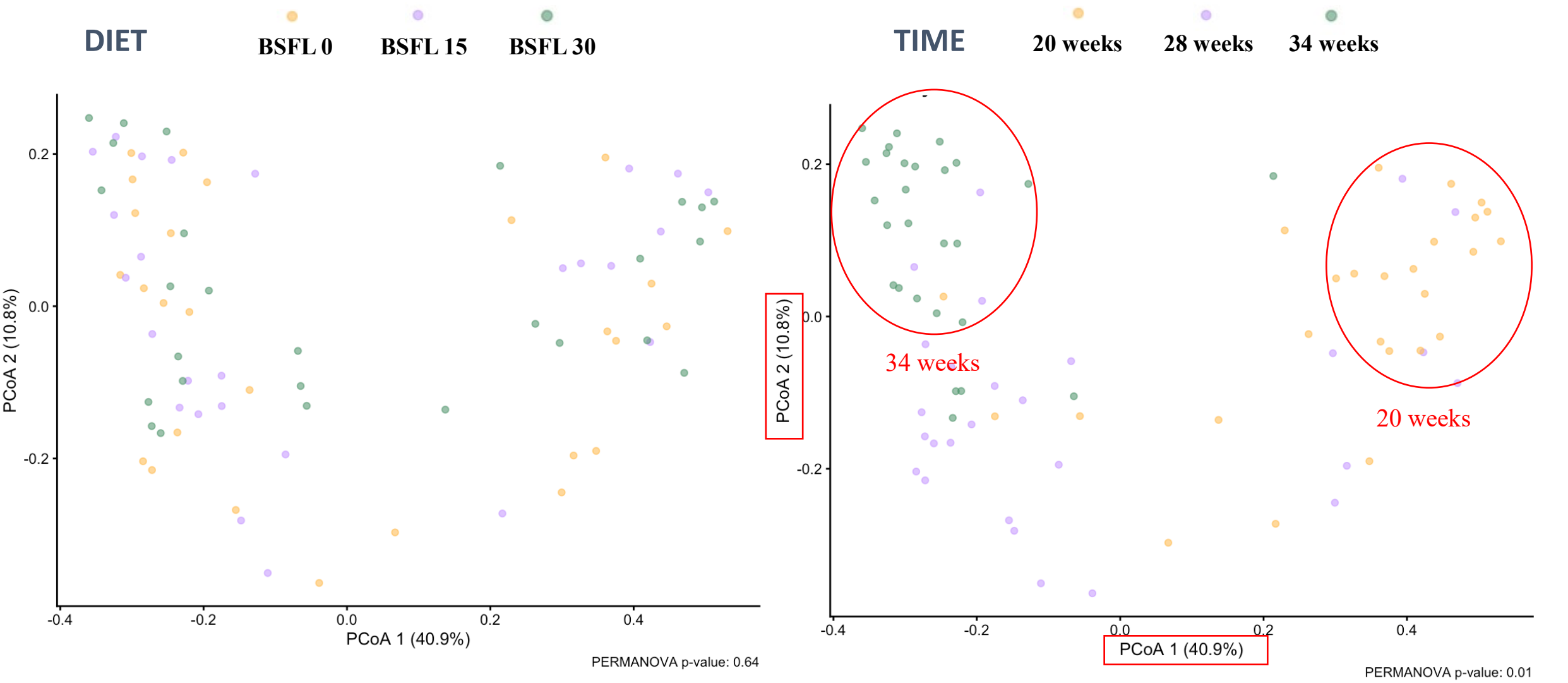


POSITIVE EFFECT OF LIVE BSF ON HENS' MICROBIOTA

3.3. Hens' microbiota – Beta diversity

PCoA Bray-Curtis distance

Dissimilarity of taxonomic composition



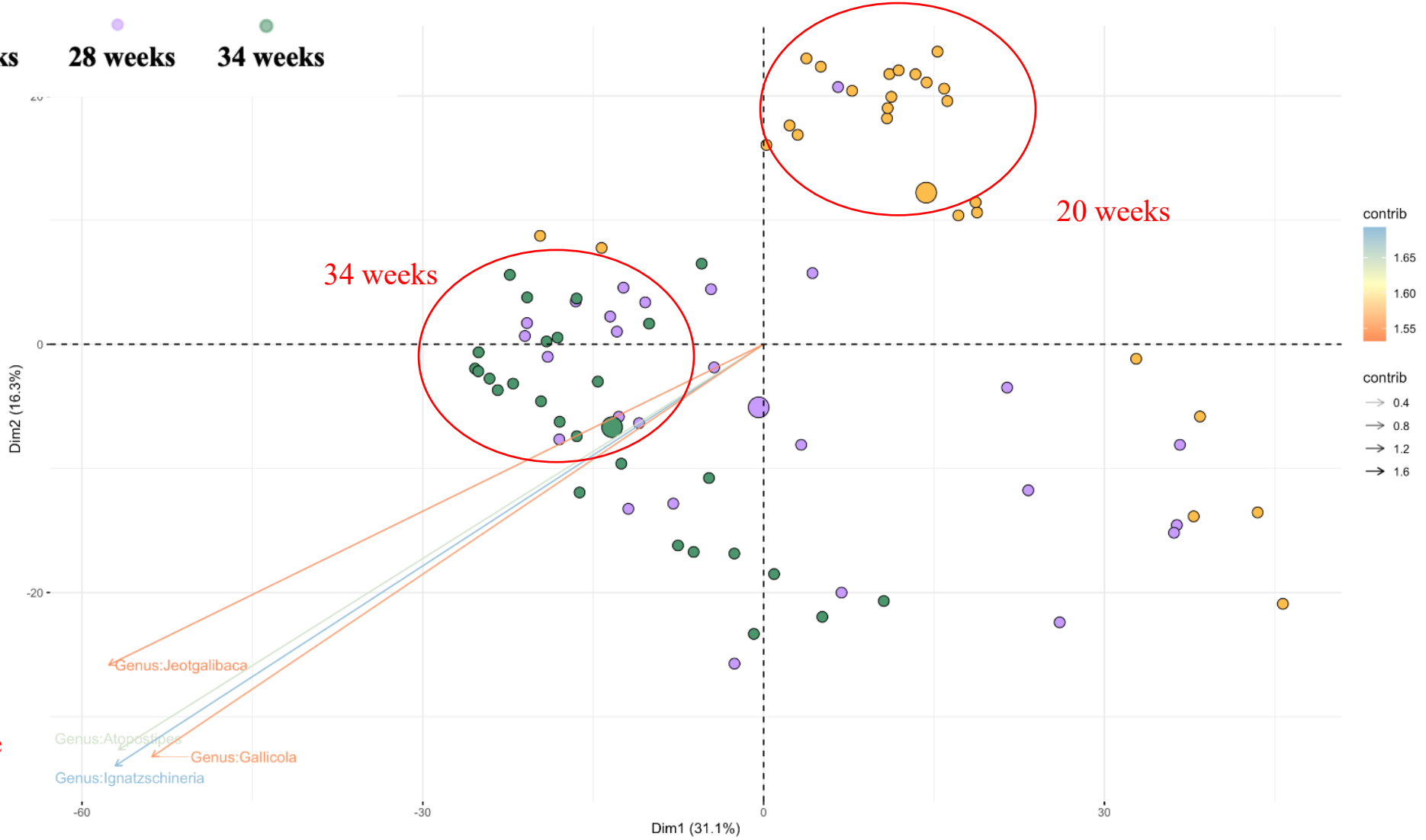
3.3. Hens' microbiota – Beta diversity

PCA

Reduce the complexity of datasets by identifying patterns and trends in the data

TIME

20 weeks 28 weeks 34 weeks



Principal taxa contributing to the clustering

4. Conclusions

- No negative effect of live BSF on animals' welfare.
- Reduced corticosterone concentration in BSF larvae feed groups.
- Increases microbiota differentiation over time.

BSF supplementation level: up to 30% DFI



4. Next steps

Data analysis:

- Animal performances
- Eggs' physical and chemical quality
- Economical convenience of BSF supplementation.



FINAL GOAL:

Network of insects' producers (agri-food by-products valorization) connected with local chicken farmers who exploit them as feed source.





Thanks for your attention

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