

Insects in poultry feed: A meta-analysis of the effect on average daily gain



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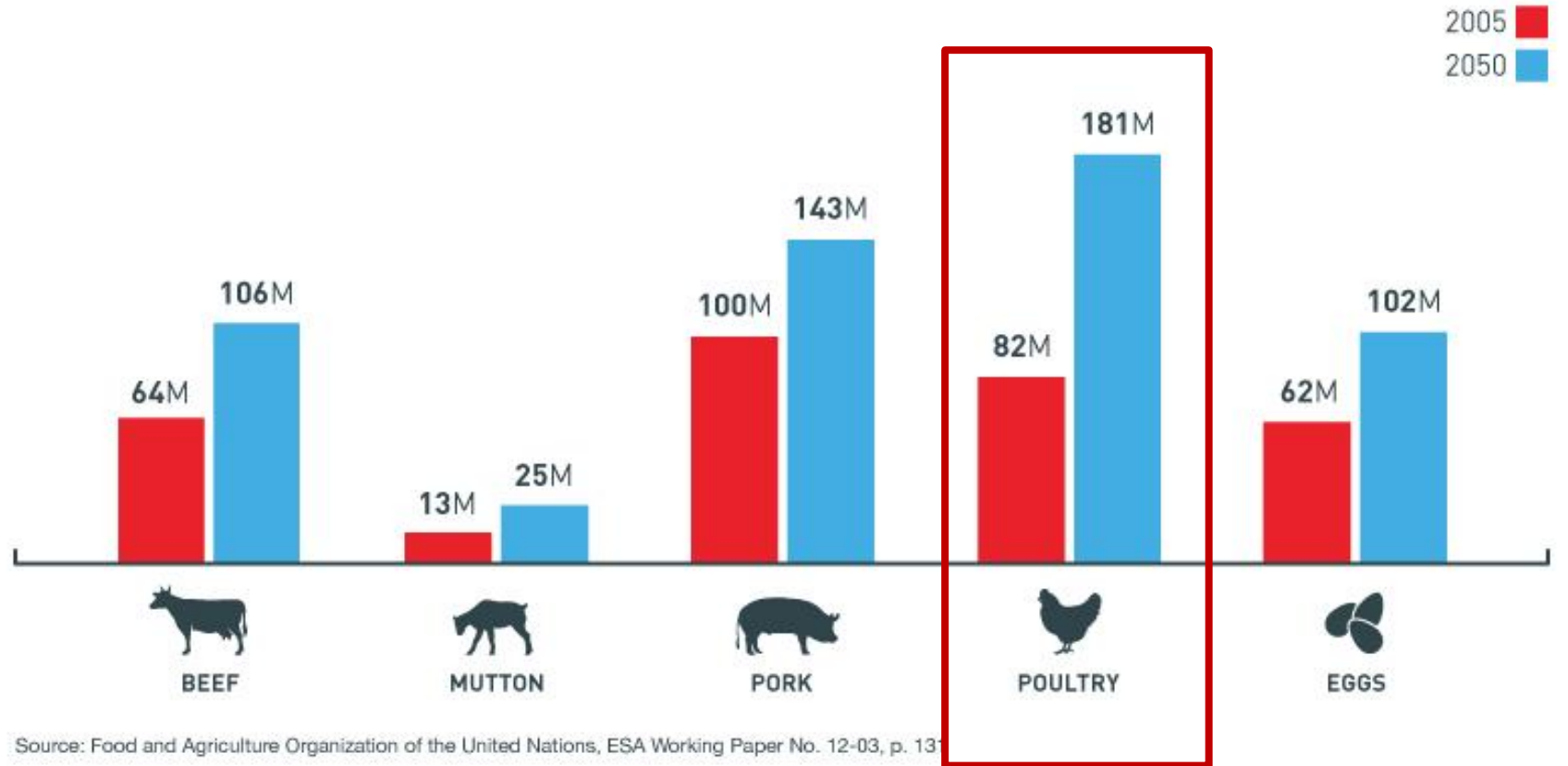


Introduction

GLOBAL DEMAND FOR MEAT

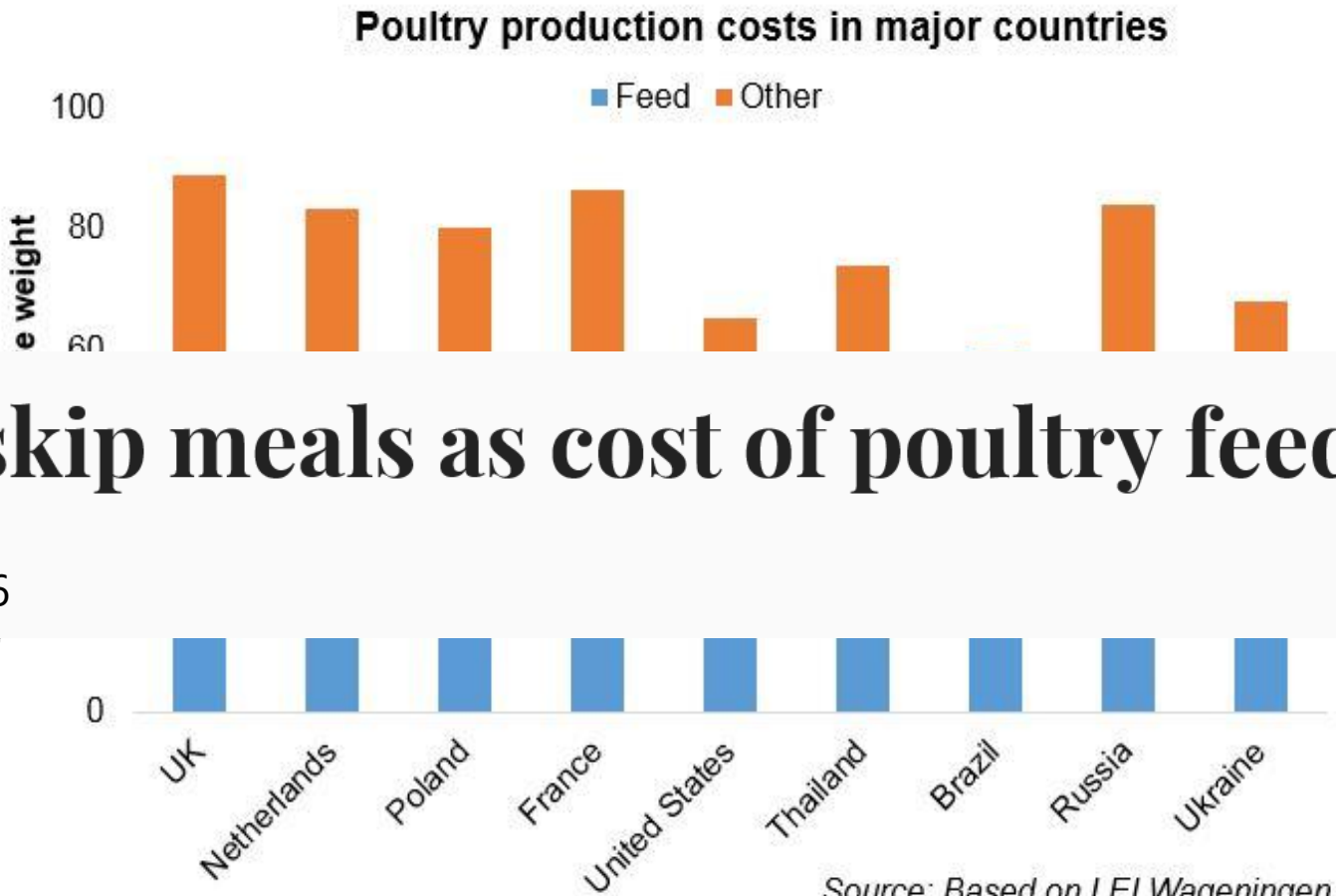
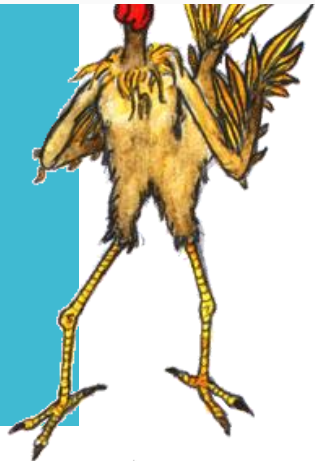
2005 vs. 2050

[in tonnes]



FEATURED

Chickens forced to skip meals as cost of poultry feed rises by 100% Nigeria, 2016



Poultry farmers lament high cost of feeds

Introduction

Insects in poultry feed?



Introduction

Insects as a food source



High quality protein source
Source of iron & other micronutrients

More efficient conversion of feed to food than conventional livestock



Less environmental inputs (e.g. feed, water, land)

Lower GHG emissions



Can be fed on wastes & inedible agricultural by-products



Replacing grain produced for animal feed that could feed humans instead

Issues & unknowns



Economics and scale of production



Research on food safety, nutritional information, production methods



Regulatory frameworks



Consumer attitudes



Ethical practice and animal welfare



Accessible livelihoods for small-scale farmers?



A sustainable food source for urban populations?

Introduction

A great number of studies on insects in feed



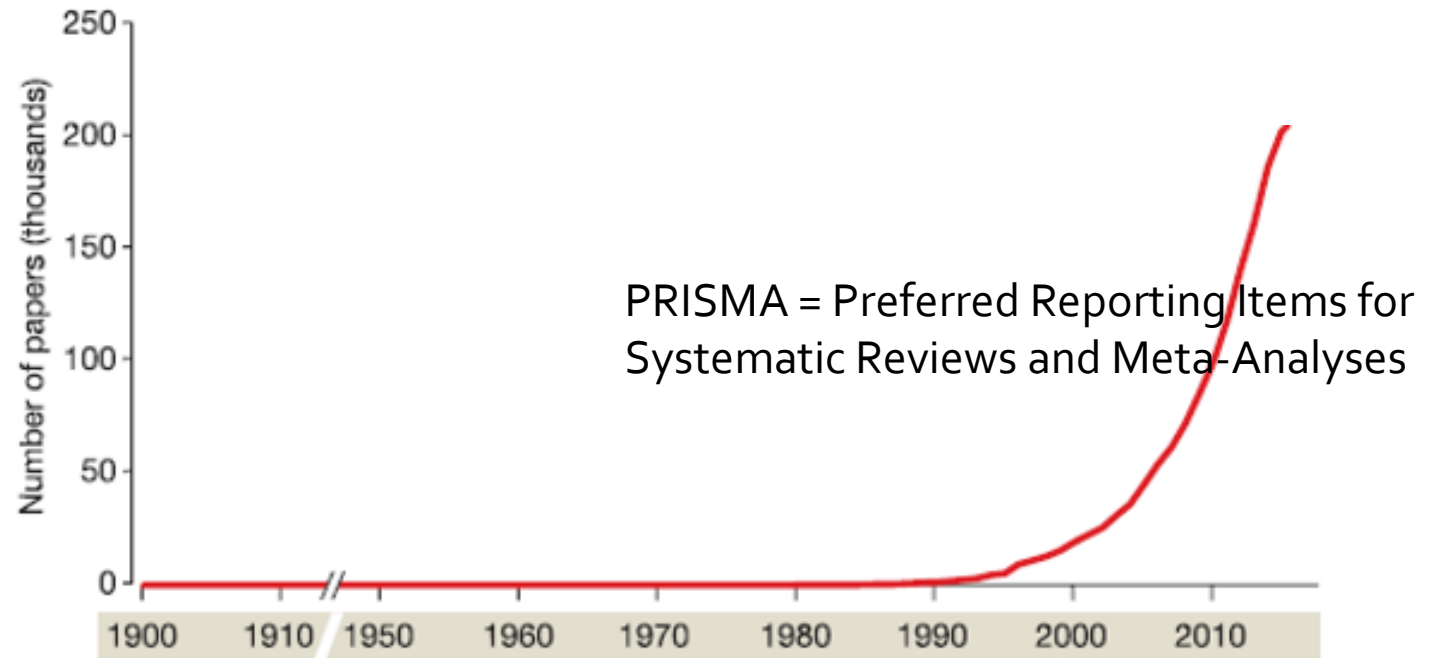
Introduction

Meta-analysis : The analysis of analyses

= **quantitative** approach for **systematically combining** results of **previous research** to arrive at **conclusions** about the body of research

Introduction

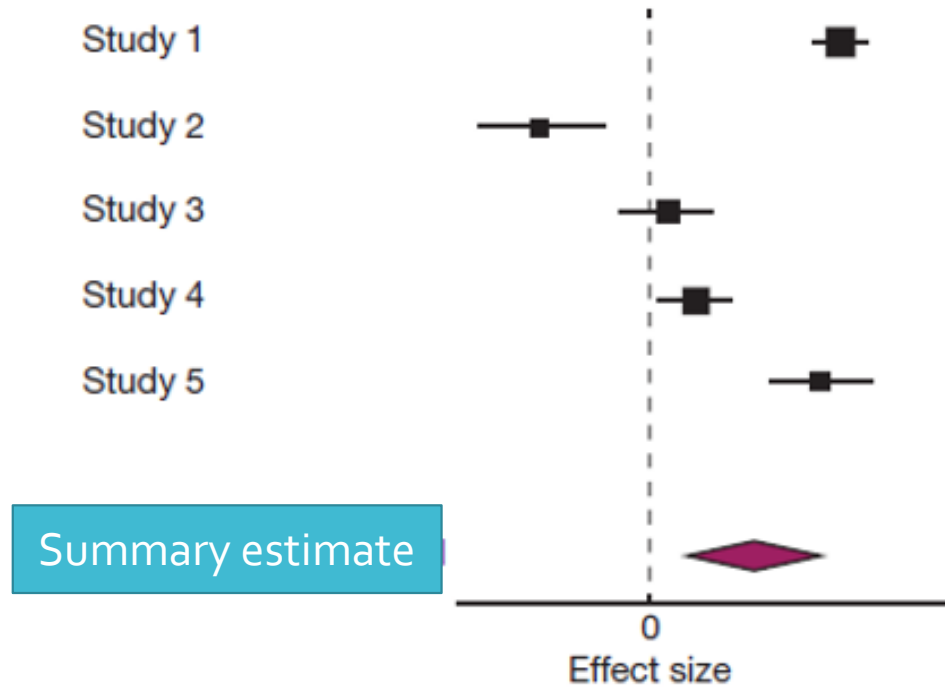
Meta-analysis : The analysis of analyses



Box 1 Figure | Milestones in the history of meta-analysis. The red line shows the number of papers from a Scopus search; the dashed

Introduction

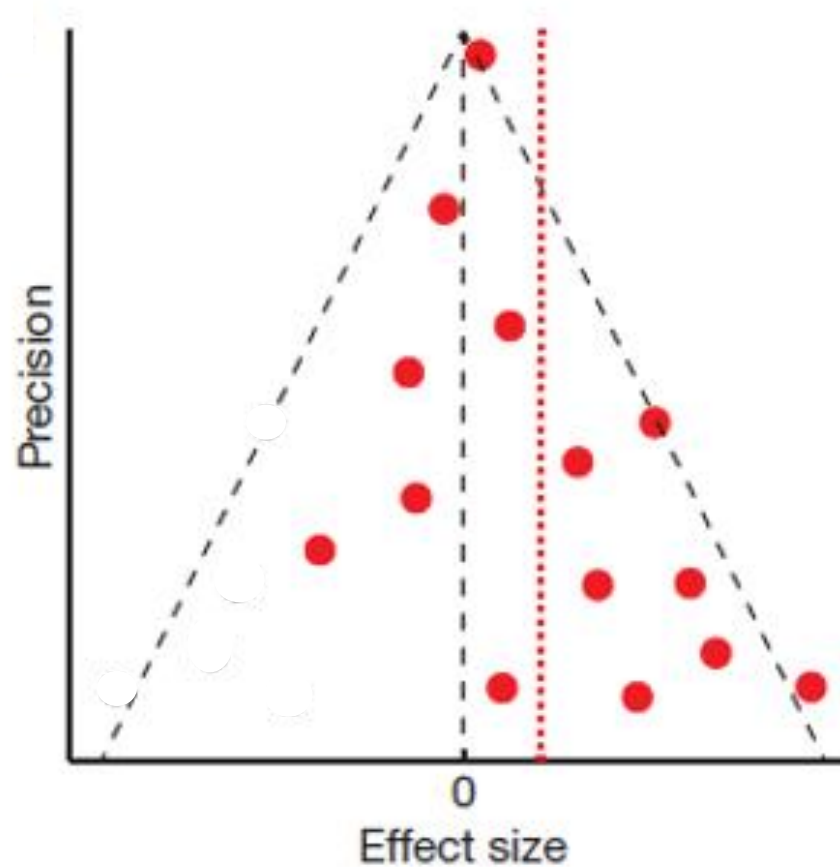
Meta-analysis : The analysis of analyses



Forest plot: Means and 95% confidence intervals of the effect-size determined from each individual studies → summary estimate

Introduction

Meta-analysis : The analysis of analyses



Funnel plot: Effect size against the precision with which it was estimated. Funnel asymmetry which could indicate publication bias.

Material and Methods

Meta-analysis of effect of feeding insects on average daily gain

Insects
Avian species
Feed



Iso-nitrogenous and iso-energetic diets
Inclusion rates (0 to 100 %)
Effect size on ADG, FCR, FI
Variability (SEM, CI, MSE)
Years of publication : 2000 to 2018
Original research
English or French

$$\text{Diff_ADG} = \text{ADG}_{\%} - \text{ADG}_{0\%}$$

Material and Methods

$$T_i \sim N(\theta_i, \sigma_i^2)$$

Meta-Regression & Mixed Effects

$$\theta_i \sim N(\mu, \tau^2)$$

Insect species
Bird species
Inclusion rates
Years of publication
Places of publication

Results

N = 41 studies, 116 trials

Insects:

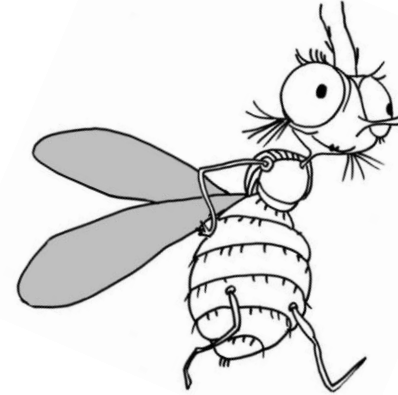
Black soldier fly: 30%

Meal worm: 20%

Maggot: 14%

Grasshopper: 13%

Cricket, silkworm or locust: 23%

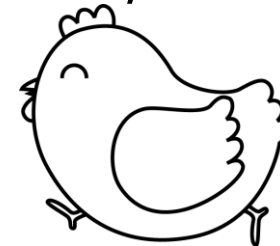


Birds:

Broiler: 69%

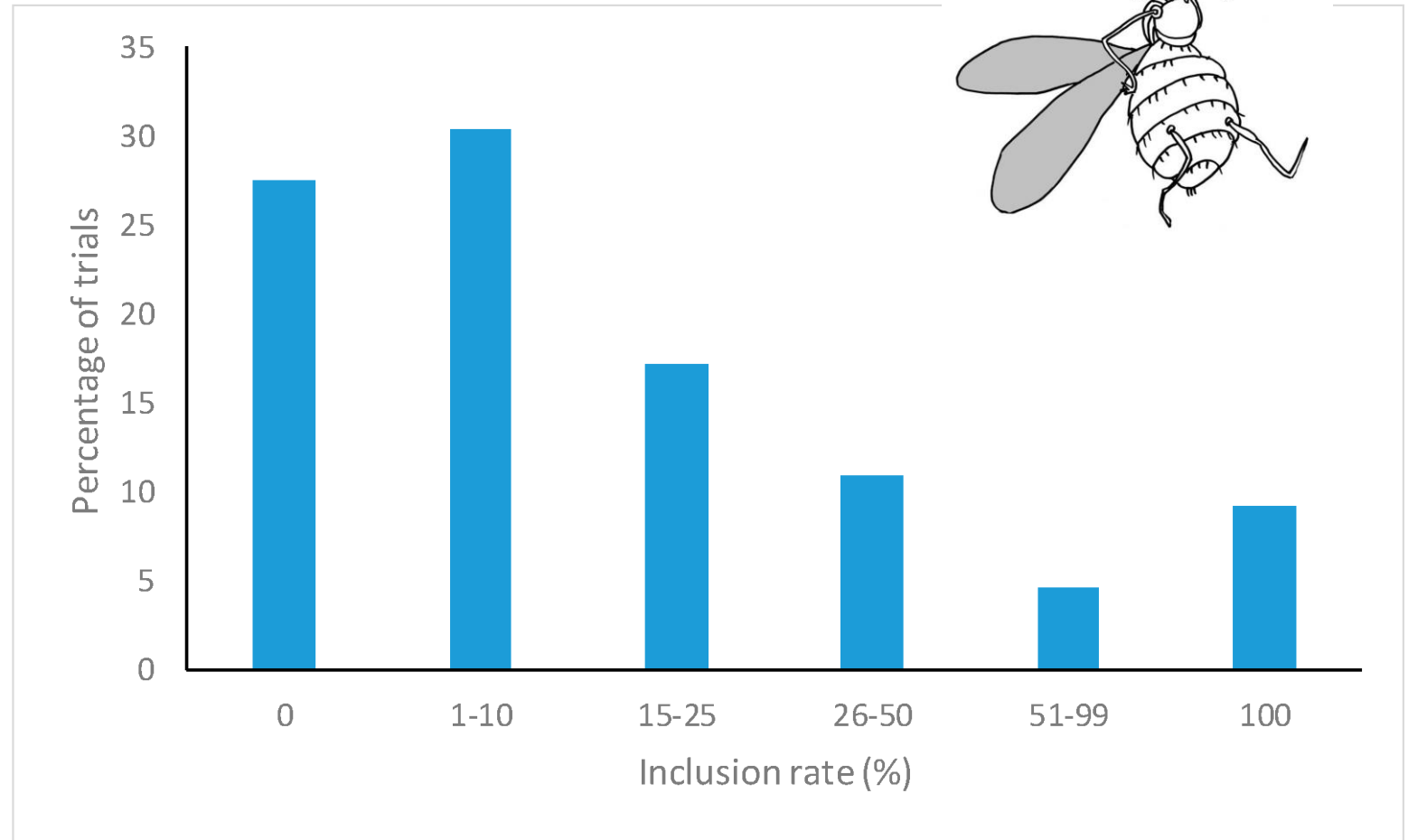
Layer: 15%

Quail, Guinea fowl, Turkey: 16+%



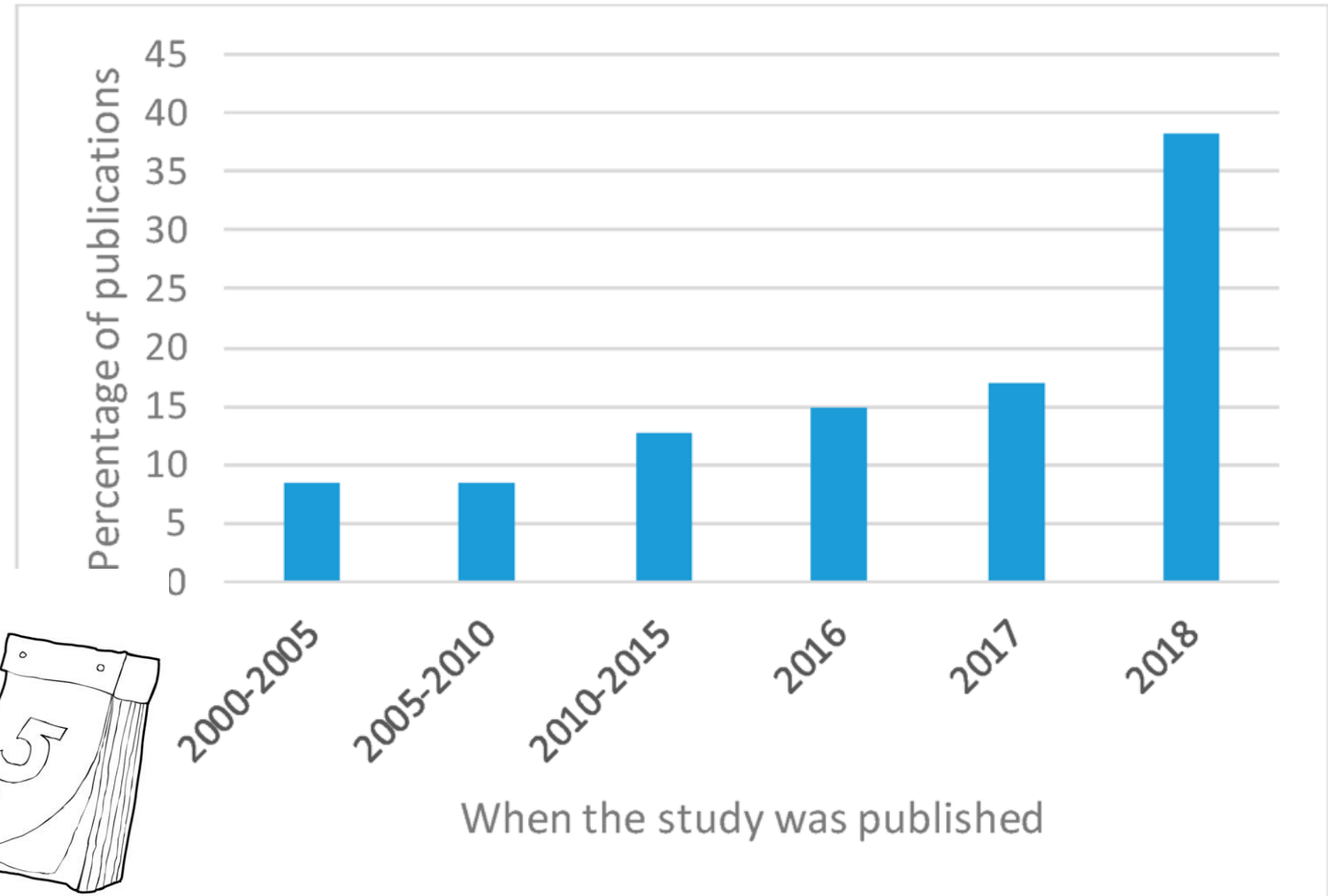
Results

Inclusion rates of insects



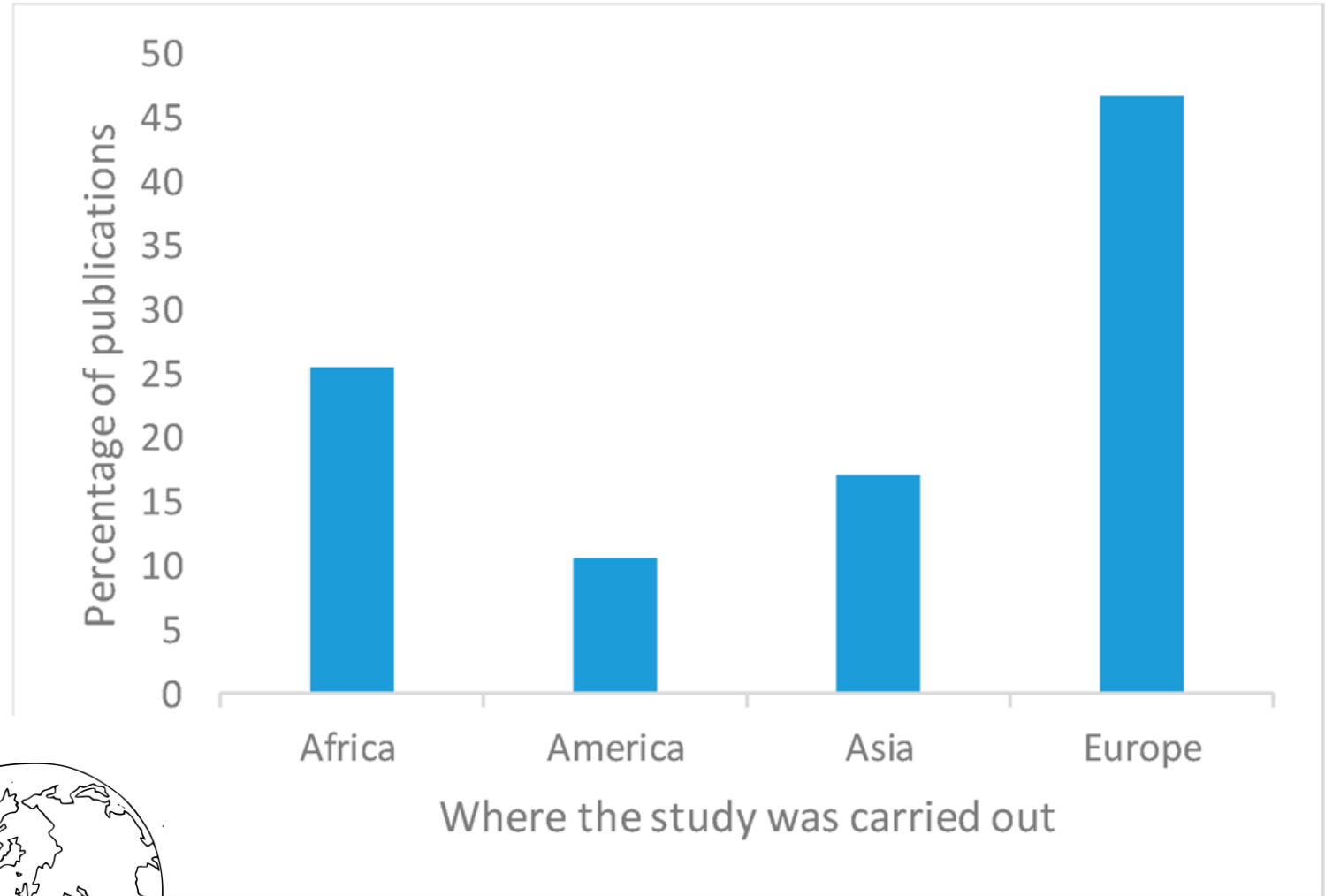
Results

Years of publication



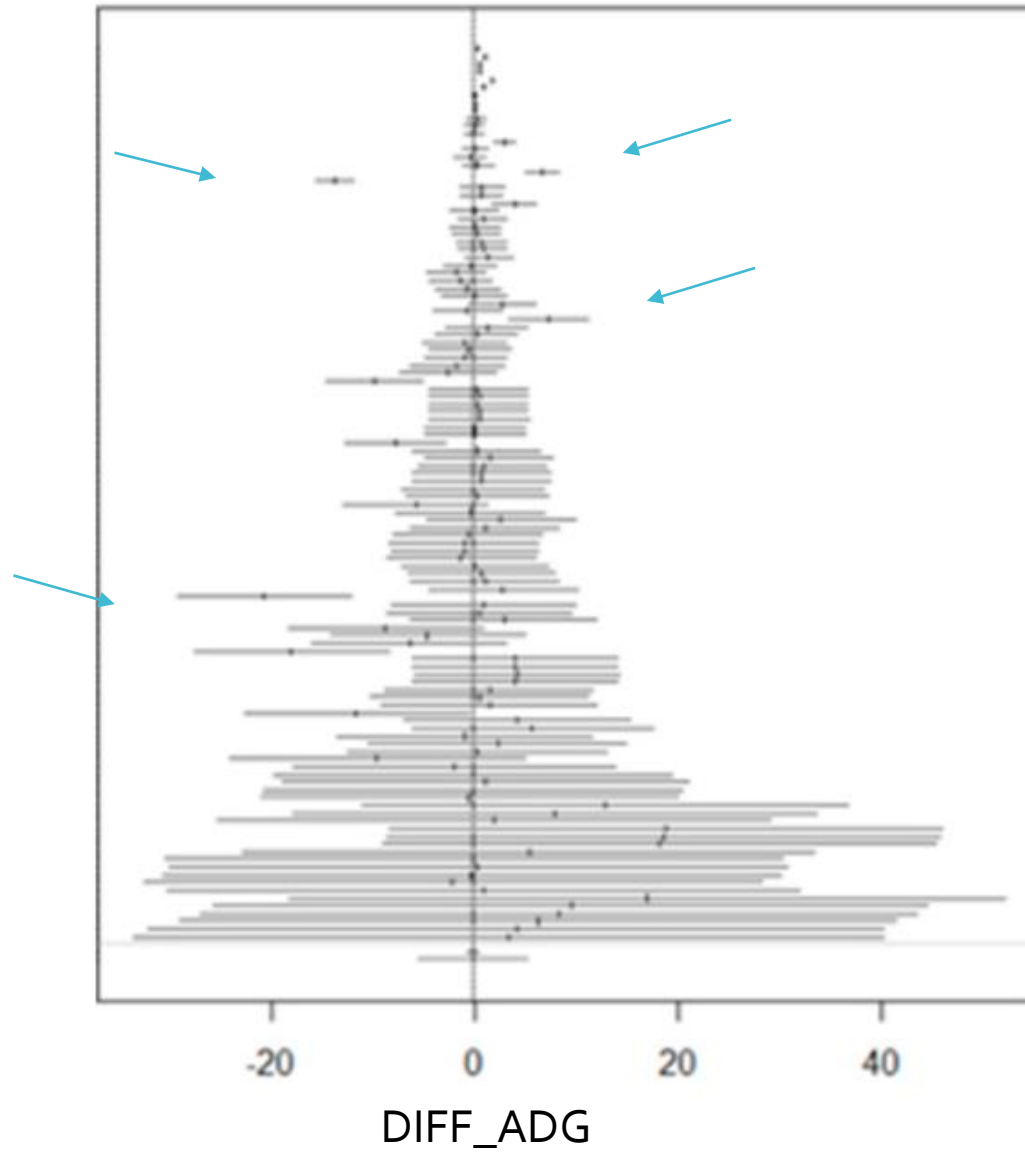
Results

Places of publication



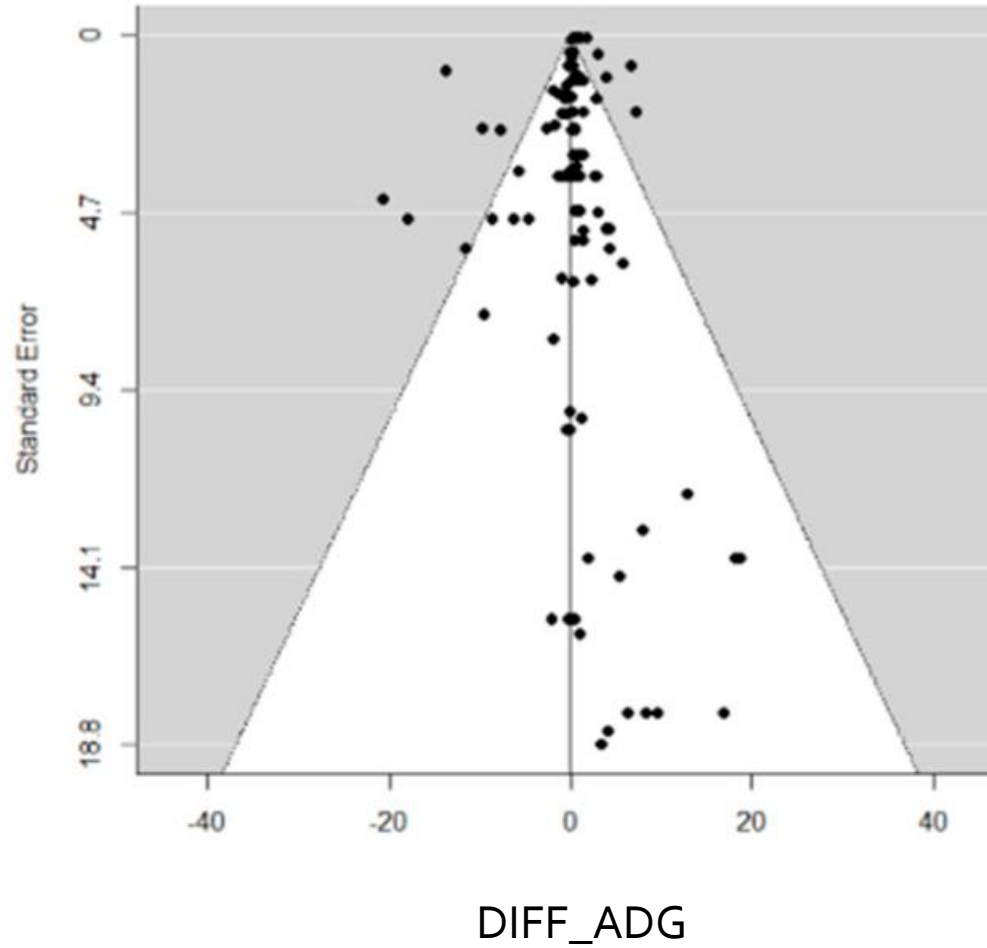
Results

Forest plot → some heterogeneity



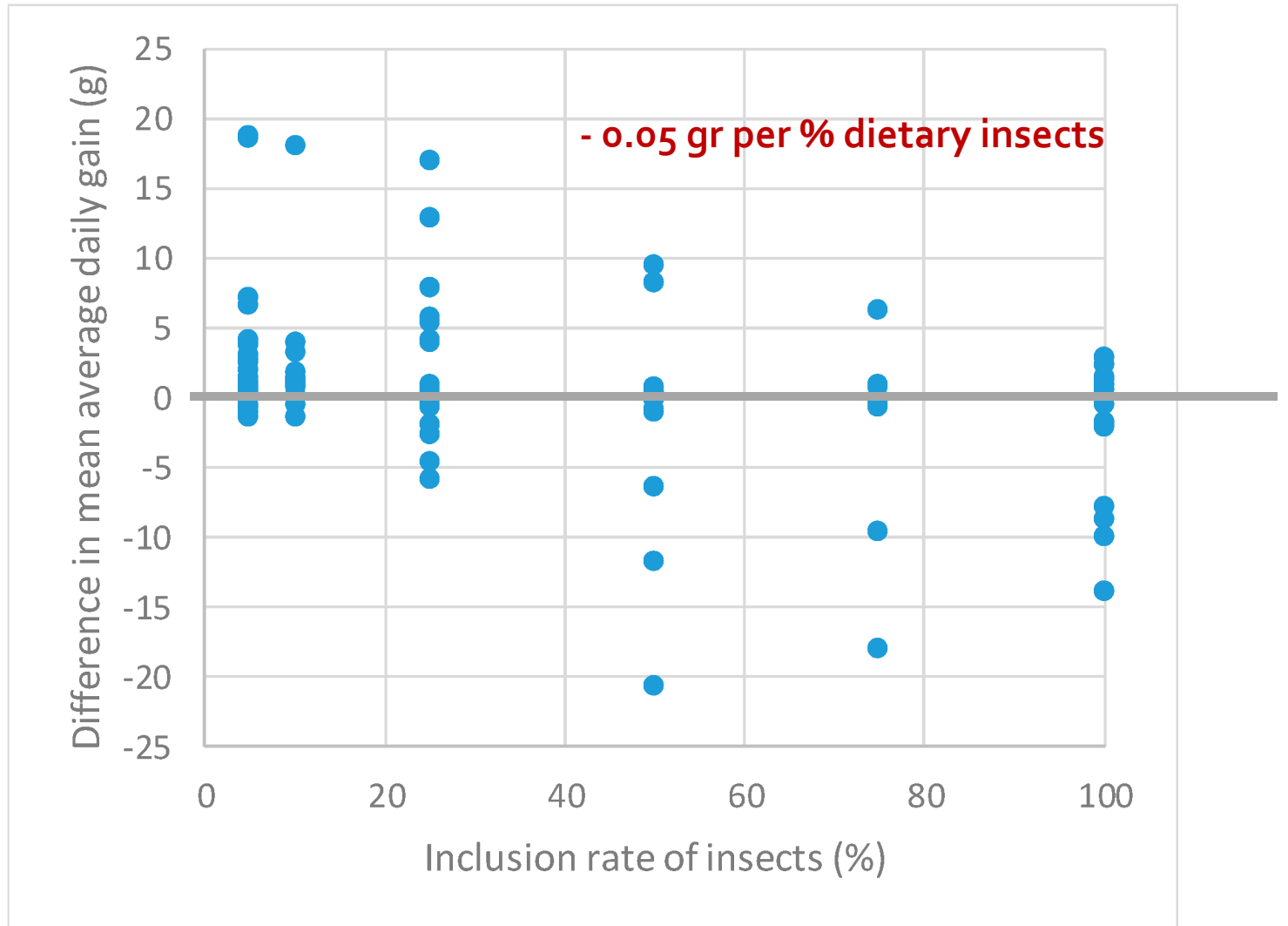
Results

Funnel plot → little publication bias



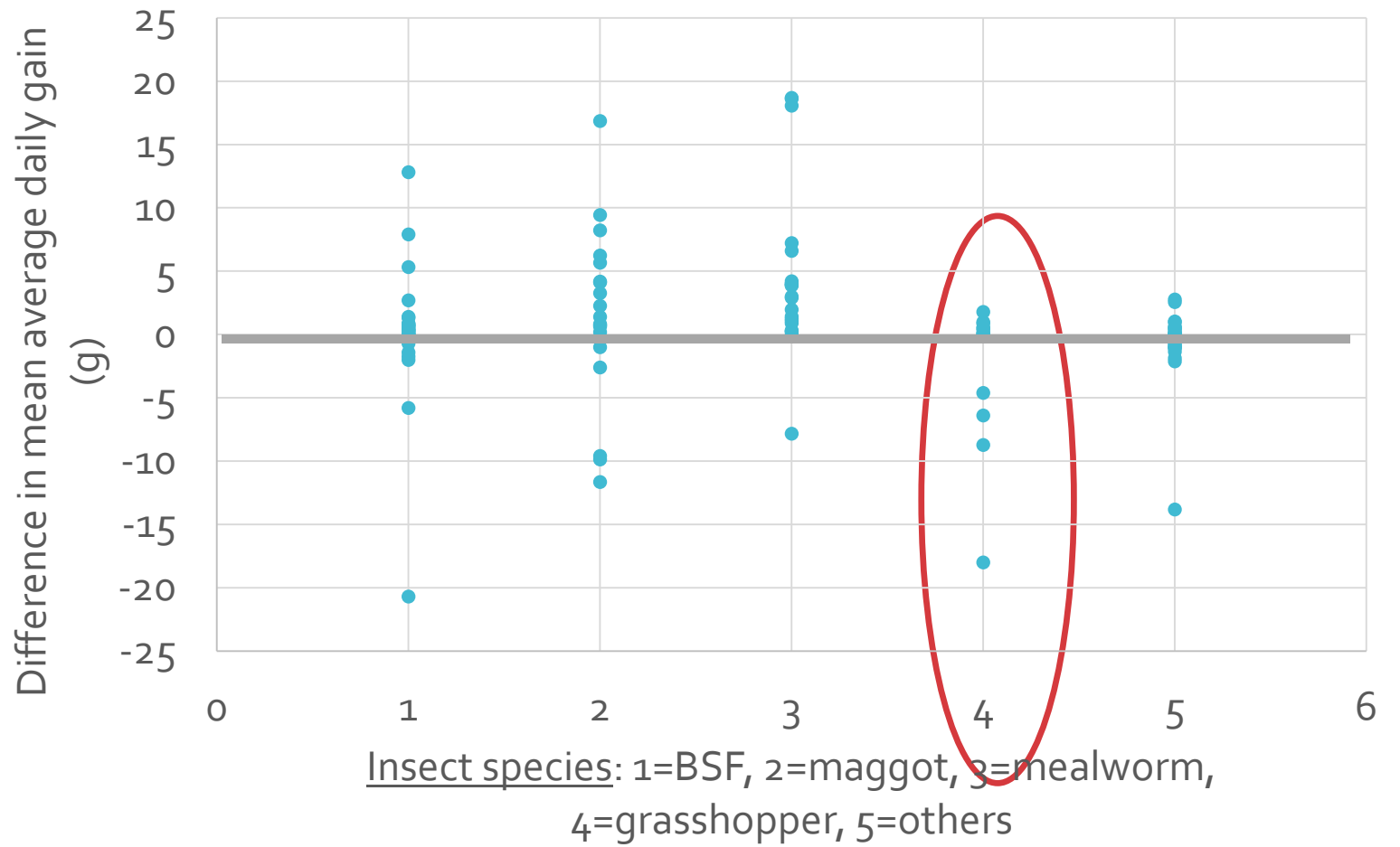
Results

Diff_ADG per inclusion rates



Results

Diff_ADG per insect species



Discussion

Etiology?

- Imbalance in nutrient profile ?
 - Amino acids profiles in black soldier fly larvae, maggots, and mealworms are ideal for broilers (Tran et al., 2018)

Discussion

Mechanisms?

- Intestinal villi heights
 - Decrease in laying hens fed high levels of black soldier fly larvae and in Ross fed high levels of mealworms (Biasato et al., 2018 ; Moniello et al., 2019)
 - No modification in Ross fed low levels of black soldier fly larvae nor in free-range chickens fed low levels of mealworms (Moula et al., 2017; Biasato et al., 2018)

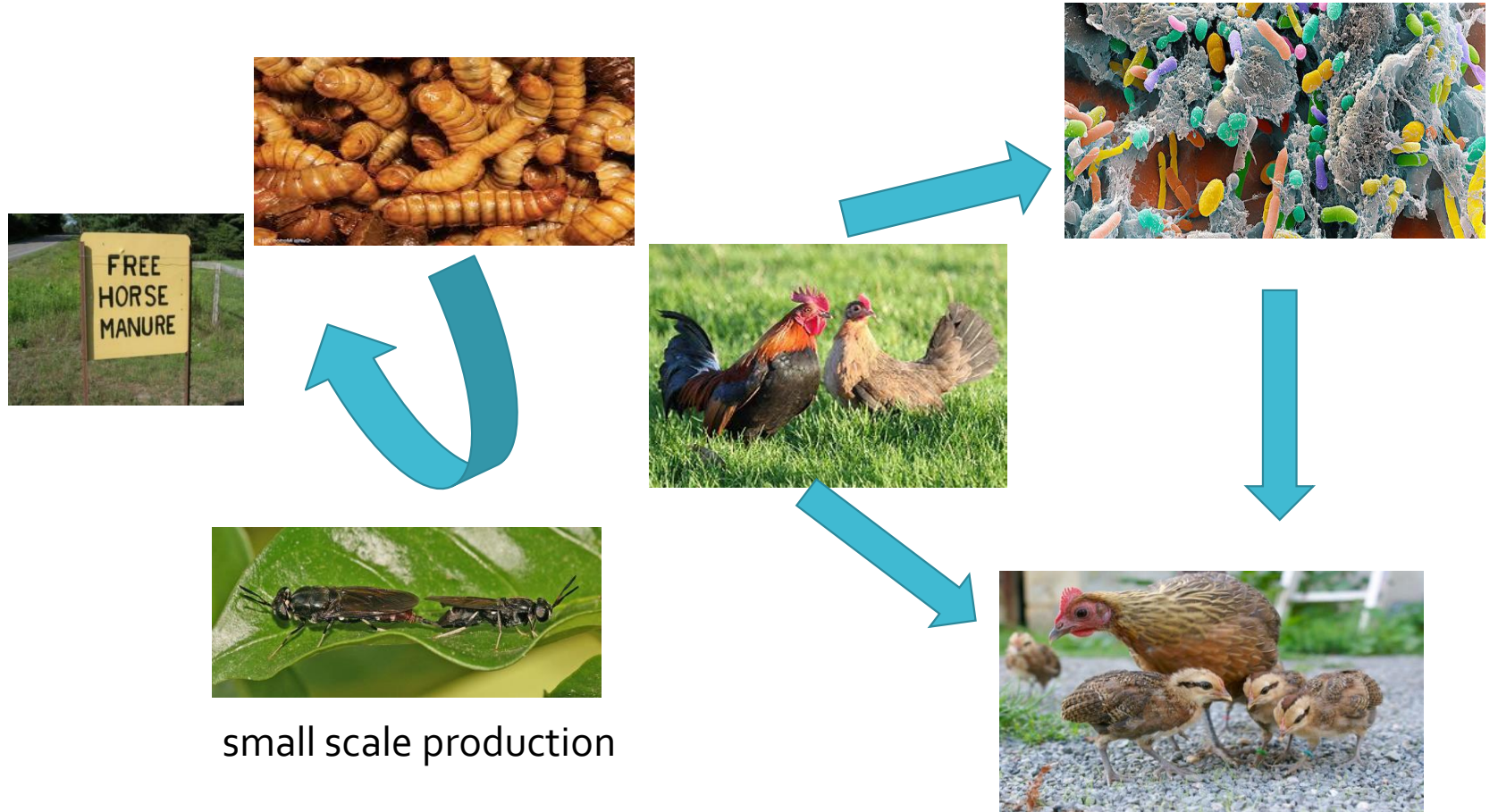
Conclusions

- Meta-analysis provided a formal and objective summary of the findings of single published studies
- May help authorities to make decisions about the approval of the inclusion of insects in poultry feed

Partial substitution of conventional feed sources will guarantee the appropriate growth of birds with the exception of grasshoppers

- **Intestinal microbiota:** composition and mediating effects of fresh larvae feeding on poultry performances and behavior (feather pecking, WQ indices)

Extra



small scale production

- **Environmental impact:** GHG emissions

Extra

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- **Intl cooperation and development:** Niger

Extra

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<http://leblogdedanieloulai.blogspot.com/2017>
<http://paepard.blogspot.com/2015>
https://archnet.org/sites/535/media_contents/10990

Questions?

Future is insects

L'AVENIR EST AUX INSECTES

ON NE CESSE
DE VOUS LE
DIRE ! We keep telling you

