



Evaluating amino acid requirements of neonatal black soldier fly larvae

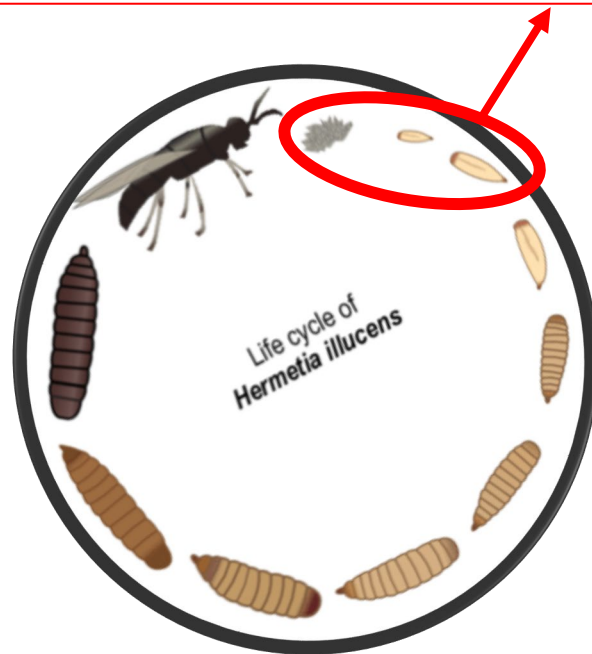
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EAAP Florence
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Larval nursery: problems & objectives

Problems:

- very sensitive neonatal phase (1.-2. instar)
- lack of knowledge on nutrient / amino acid requirements
- (excess) feeding commercial poultry / pig feed for nursing



Objectives:

- Understand neonatal dietary requirements
 - tailored nursery (pre-fattening) diet
- Reduce neonatal mortality of $\geq 25\%$
 - efficient use of reproduction resources
- Shorten nursing period
 - efficient use of nursery infrastructure
- Mitigate nursery growth heterogeneity
 - efficient use of later fattening space
- Improve ecological & economic sustainability
 - train mills, producers, consultants

Experimental design: control rations

3 control diets:

Reference-Control (RC) 18.9% CP (DM)

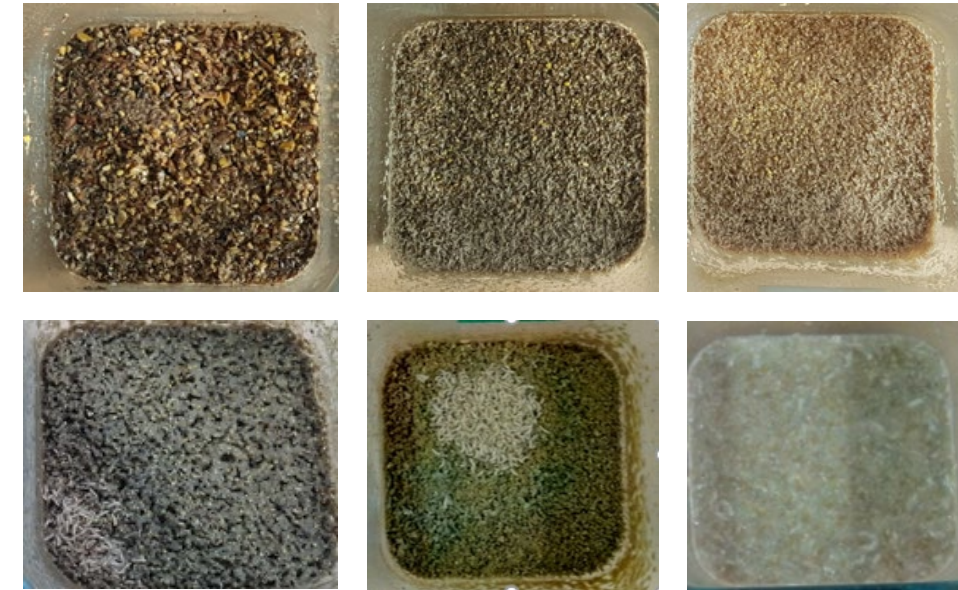
Commercial chicken feed (young layers)

Negative-Control (NC)* 11.7% CP (DM)

Semi-artificial protein-reduced
(33% RC & other ingredients)

Positive-Control (PC)* 18.9% CP (DM)

NC plus 20 synthetic amino acids (supplemented to RC levels)



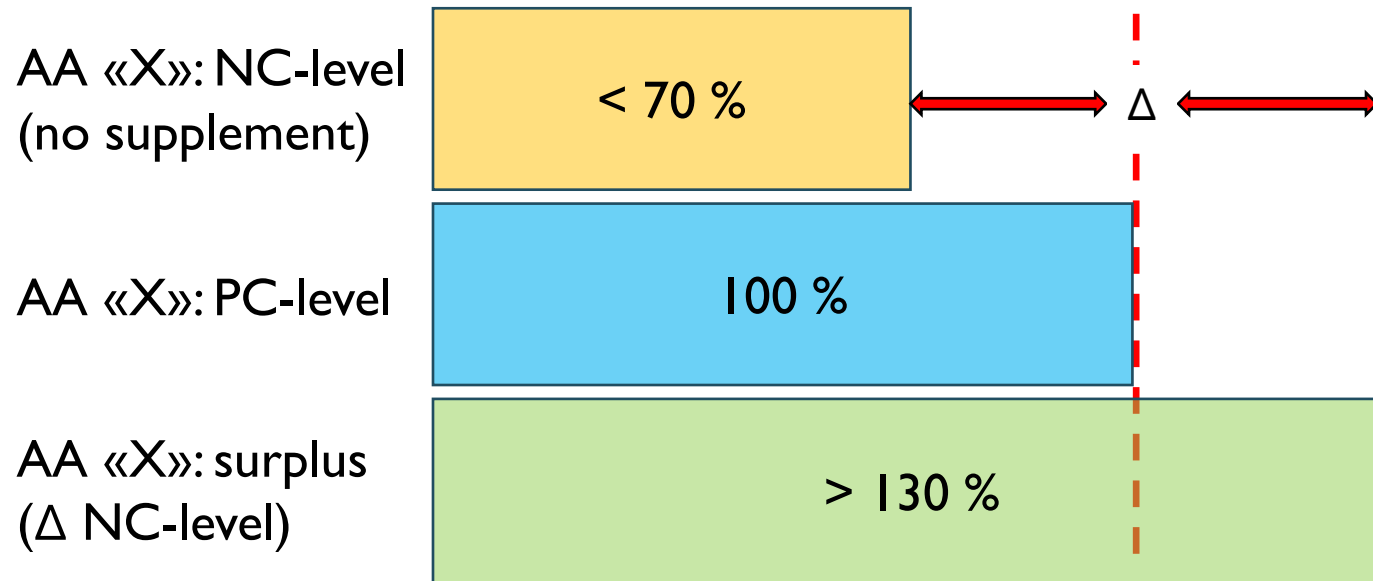
(Random examples)

Vitamins & trace minerals controlled throughout (same formula as in RC);

* same particle size (0.5 mm), slightly different moist texture due to structuring components.

Experimental design: amino acid (AA) manipulations

12 treatments: reductions & supplementations of 6 essential AA



AA reduction	Δ (% PC)	AA supplement
Arg -	± 46	Arg +
Ile -	± 40	Ile +
Met -	± 41	Met +
Thr -	± 42	Thr +
Trp -	± 31	Trp +
Lys -	± 46	Lys +

3 replicates of all 15 experimental groups

Experimental design: neonate feeding & monitoring



Moistening of
homogenised
diets



Feed provisioning: 2 x 50 g DM
(10 mg DM / neonate)
End: completely churned bottom



10,000 neonates
à 17.9µg

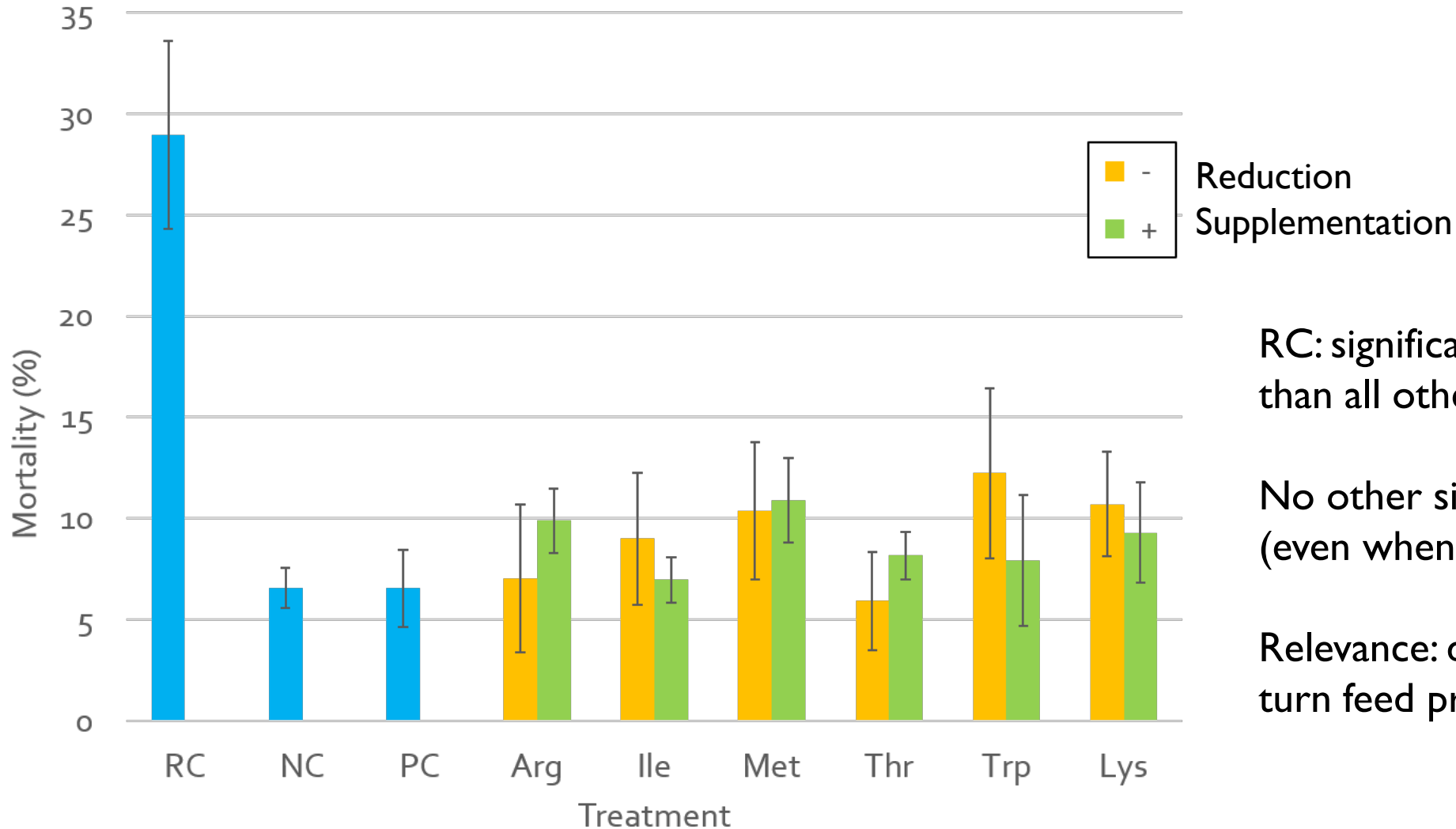


Climate cabinet with containers
(shuffled daily)



Washing/weighing of BSFL
subsamples (Days 6-10)

Results: Mortality

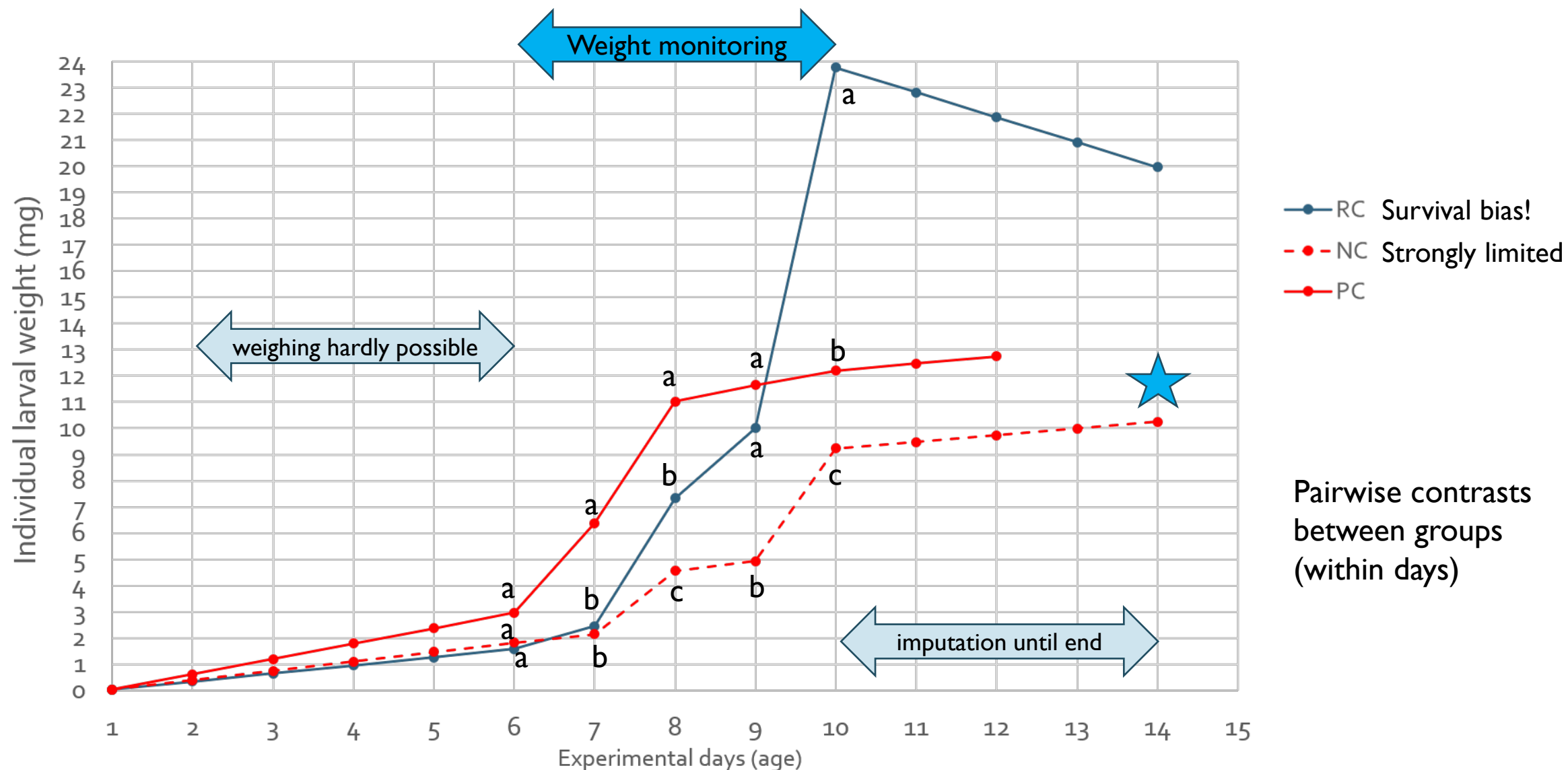


RC: significantly higher mortality than all other groups.

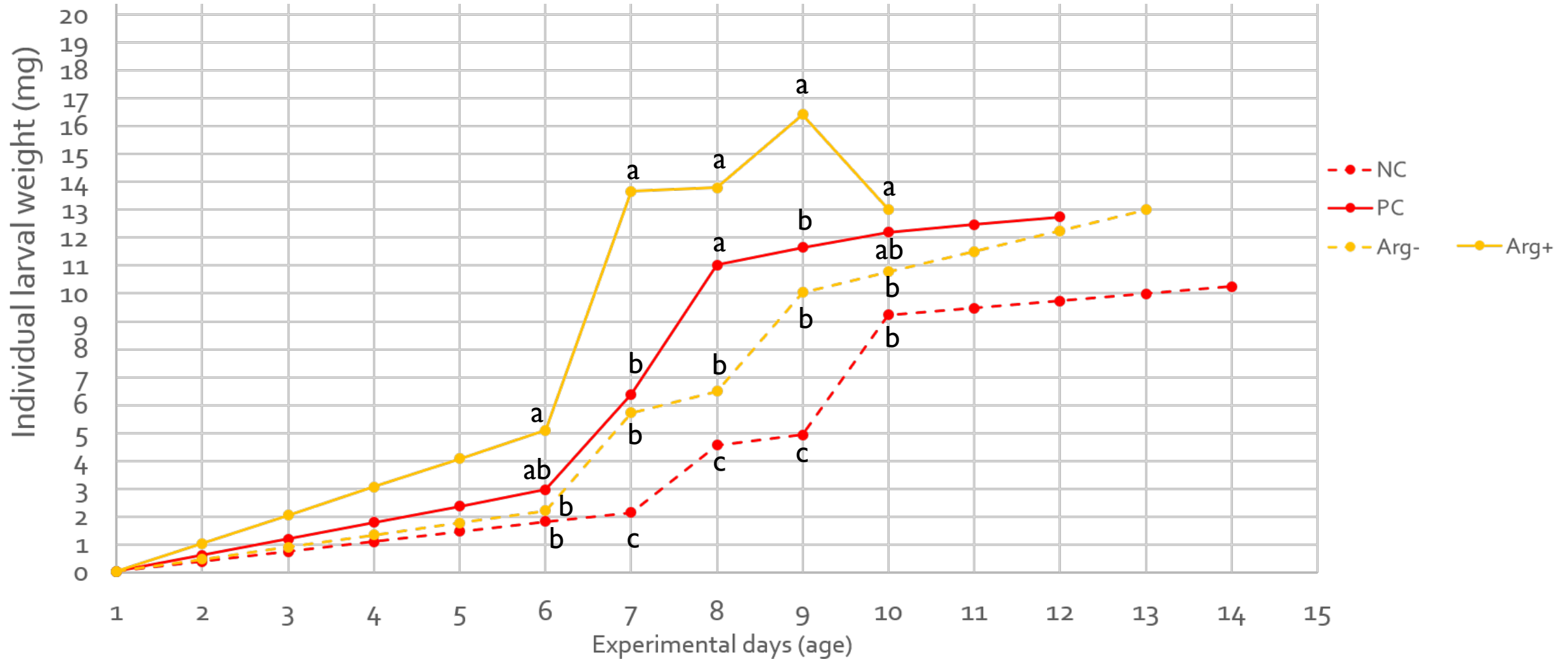
No other significant pairwise contrast (even when excluding RC).

Relevance: different survival would turn feed provision into a variable!

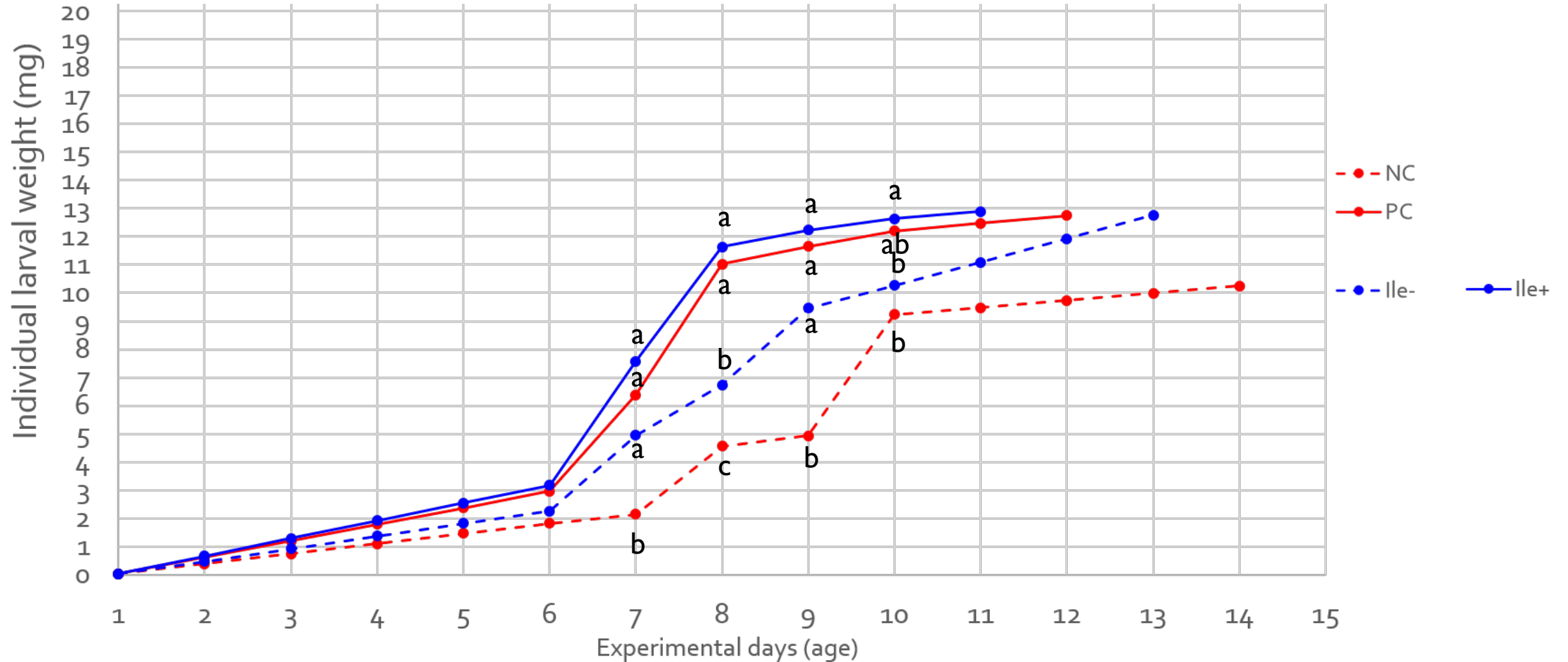
Results: Growth dynamics - controls



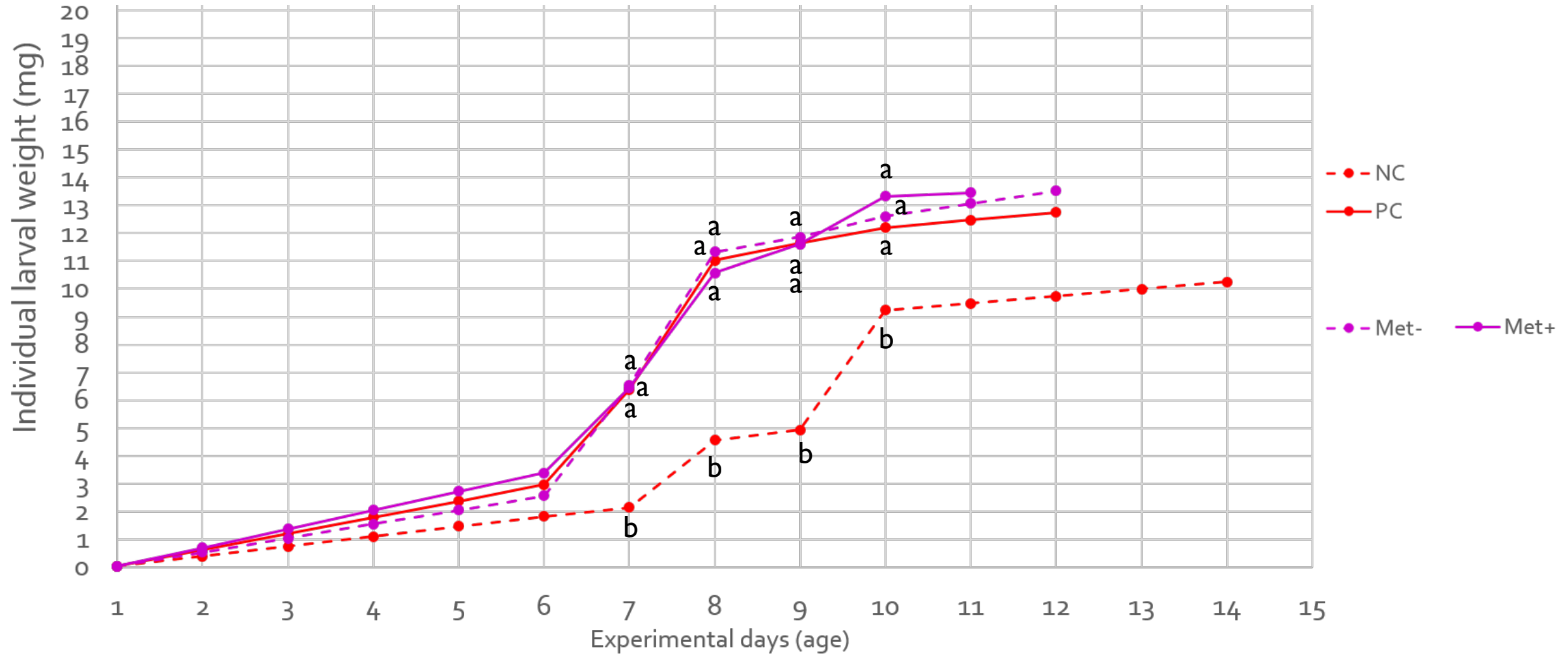
Results: Growth dynamics $\pm$ 46% Arginine



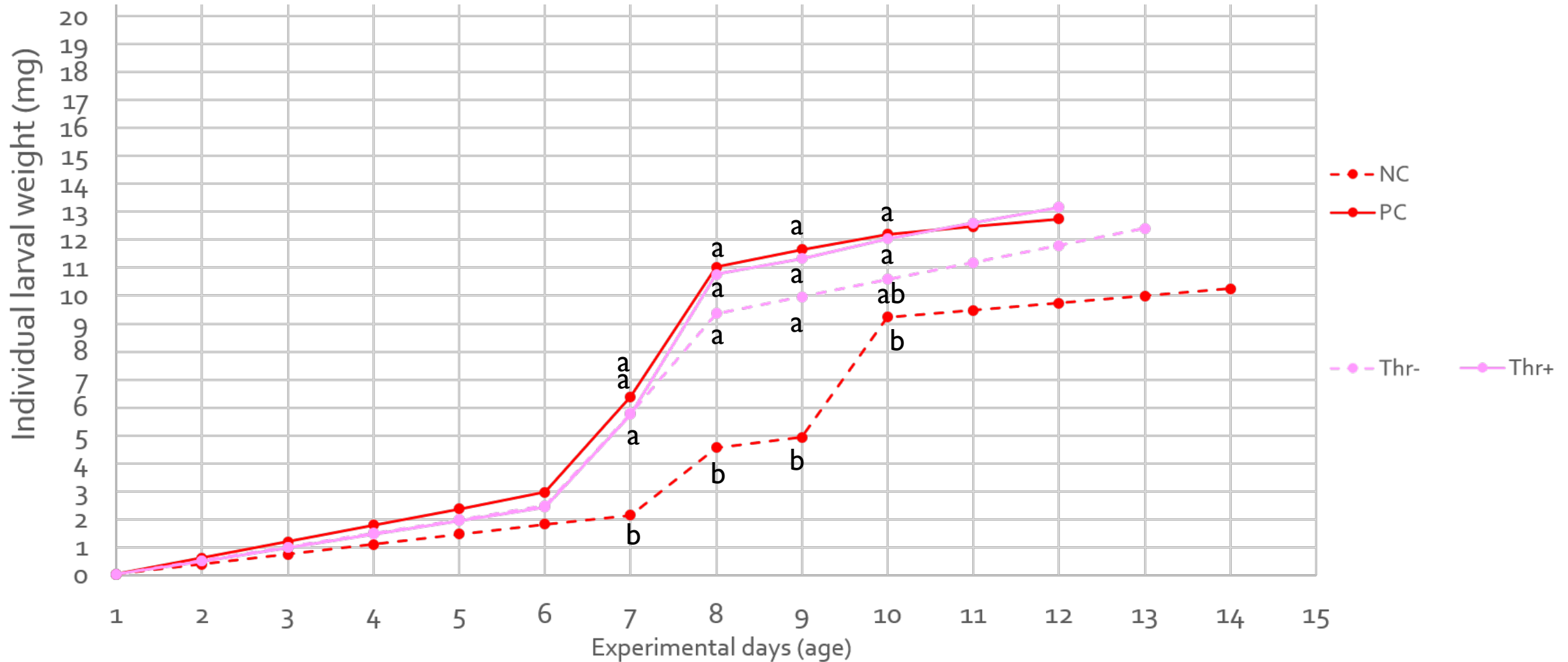
Results: Growth dynamics $\pm$ 40% Isoleucine



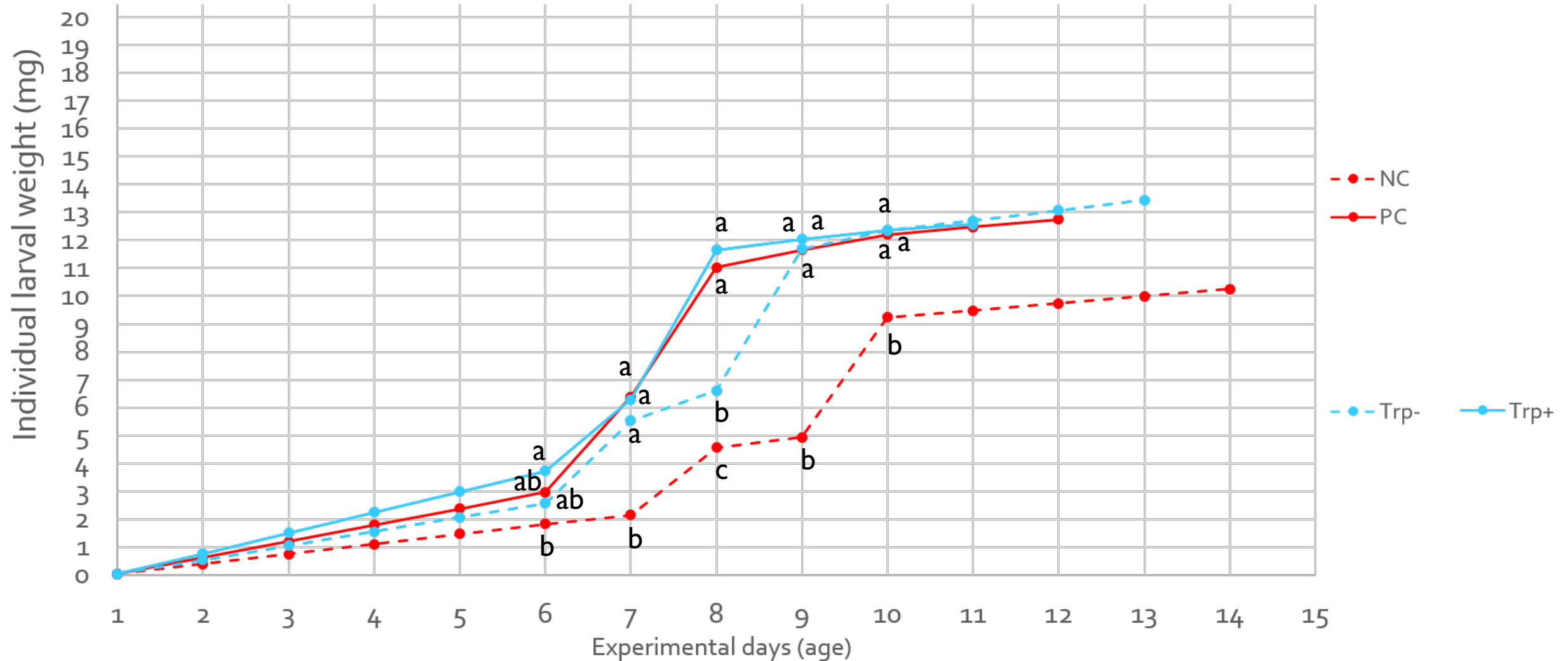
Results: Growth dynamics $\pm$ 41% Methionine



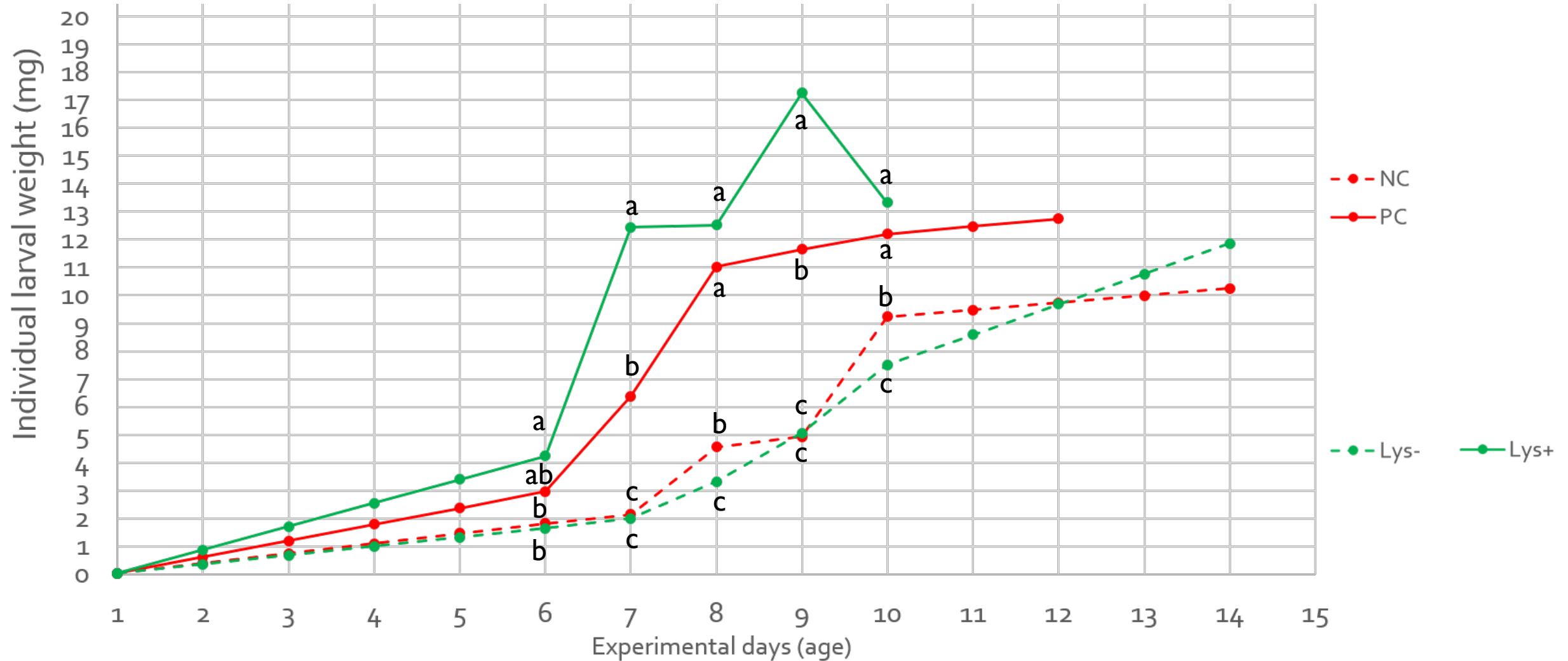
Results: Growth dynamics $\pm$ 42% Threonine



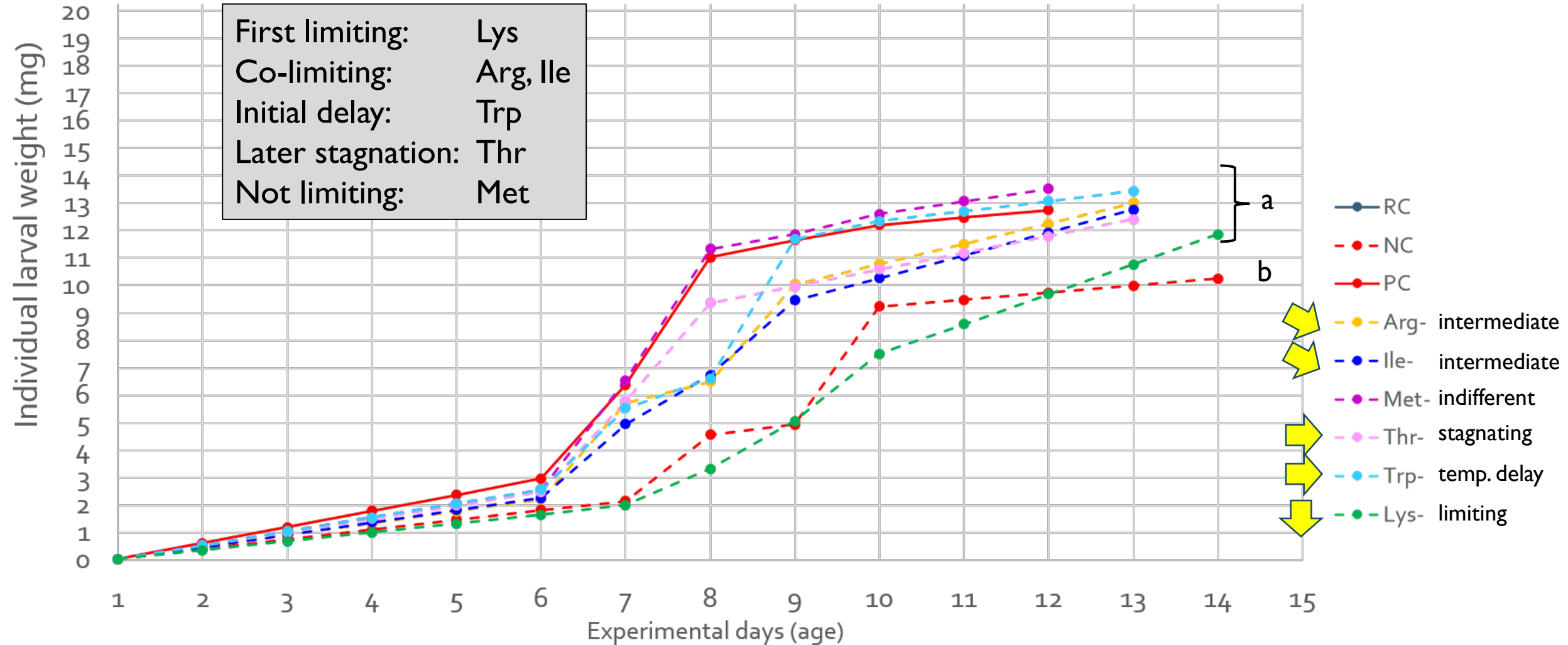
Results: Growth dynamics $\pm$ 31% Tryptophane



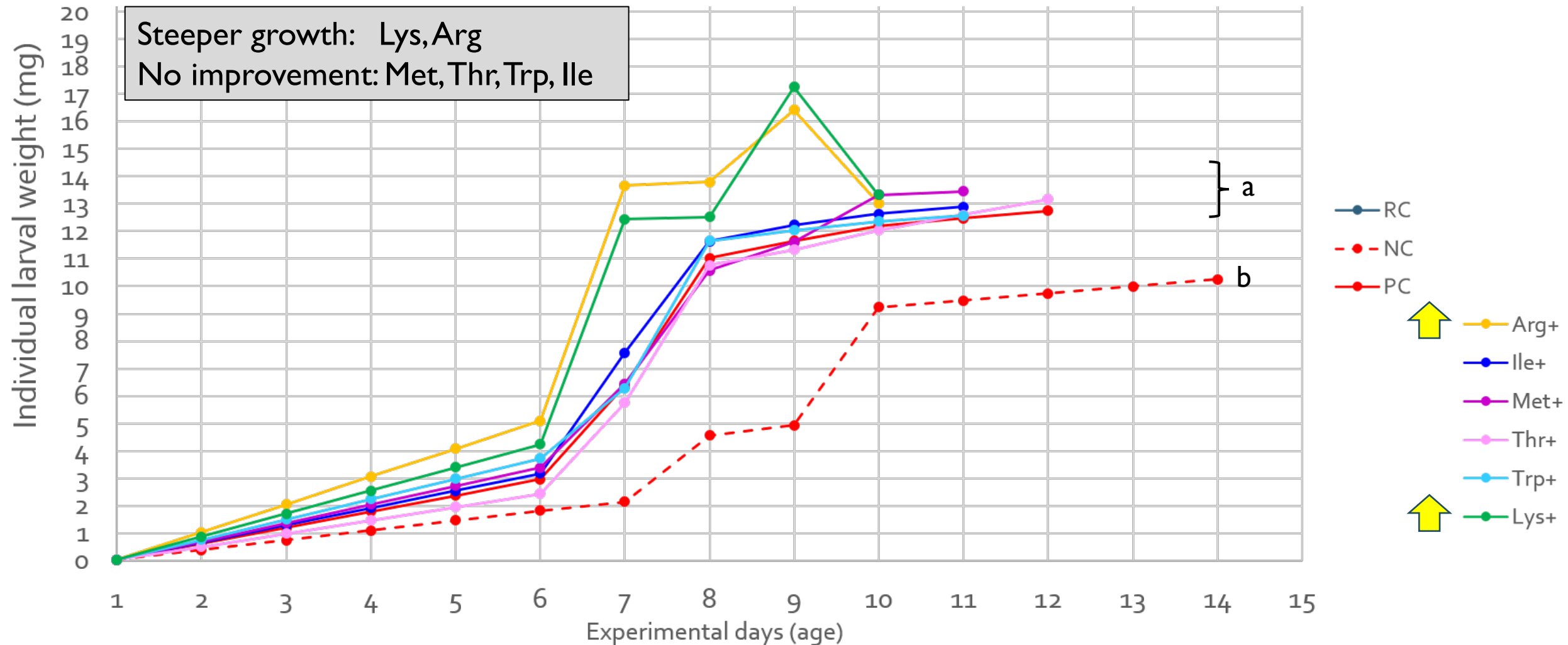
Results: Growth dynamics $\pm$ 46% Lysine



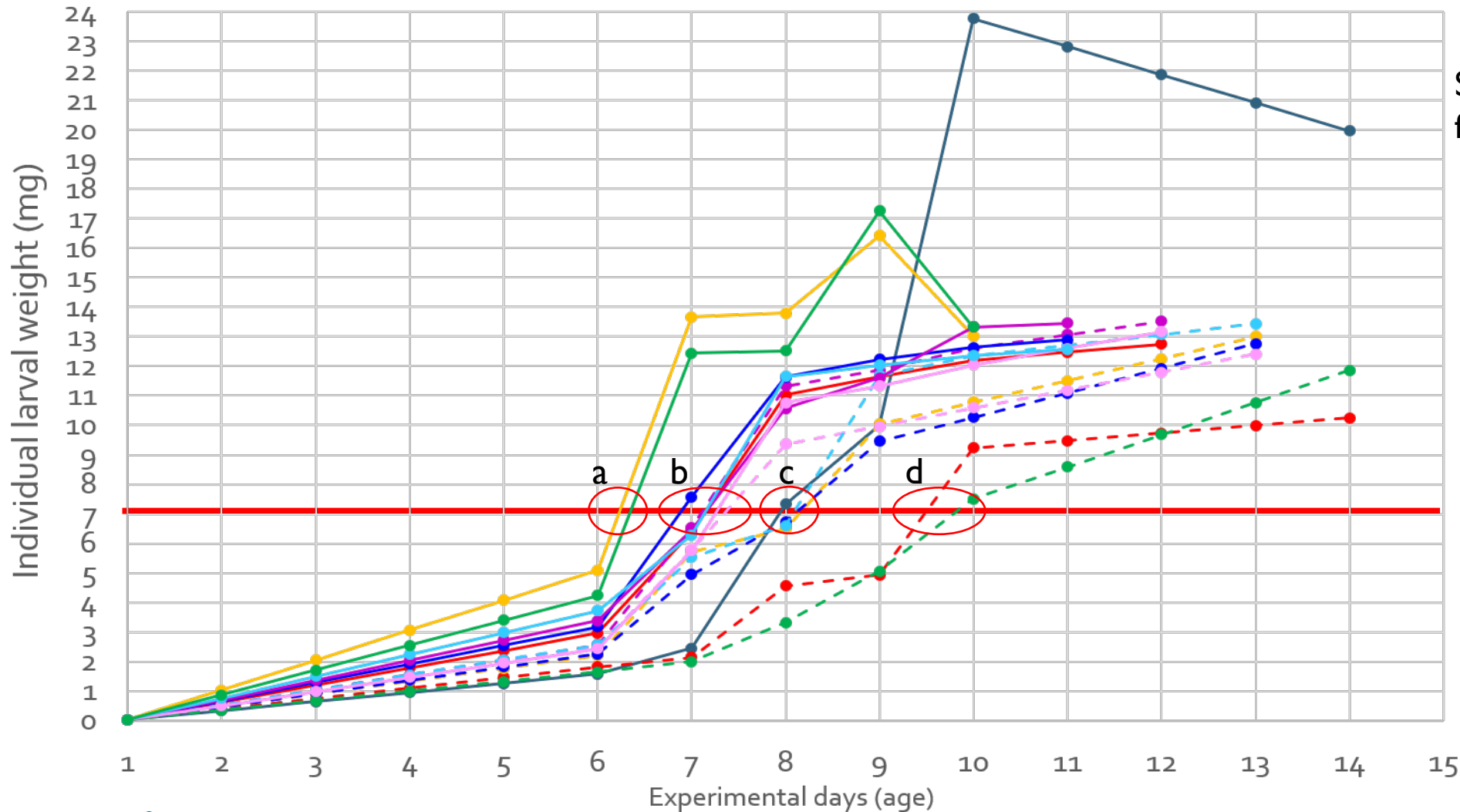
Results: Growth dynamics & final weights (reductions)



Results: Growth dynamics & final weights (supplementations)



Results: time to reach target weight for fattening



Conclusions

Mortality

- feed texture (neonatal habitat) can significantly affect mortality
- neither crude protein nor AA reductions or supplementations affect survival

Amino acid requirements (referring to actual dietary baseline!)

- crude protein content $\approx$ end-of-nursery larval biomass – yet AAs shape temporal dynamics
- neonatal Lys & Met responses $\neq$ those in $> 2^{\text{nd}}$ instar larvae – stage-specific requirements
- further refining AA balances for designing tailored nursery diets seems plausible

~30% less feed, ~65% reduced neonatal mortality, ~25% less nursery time, space & energy
- promising efficiency increase!

Thanks to all partners of the Projekt „reKult4Food“:

GEFÖRDERT VOM



Bundesministerium
für Bildung
und Forschung



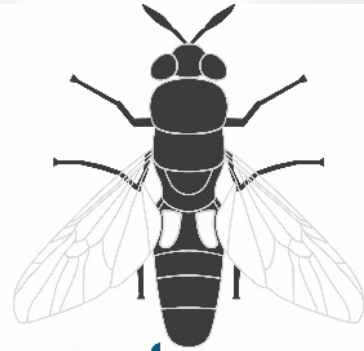
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