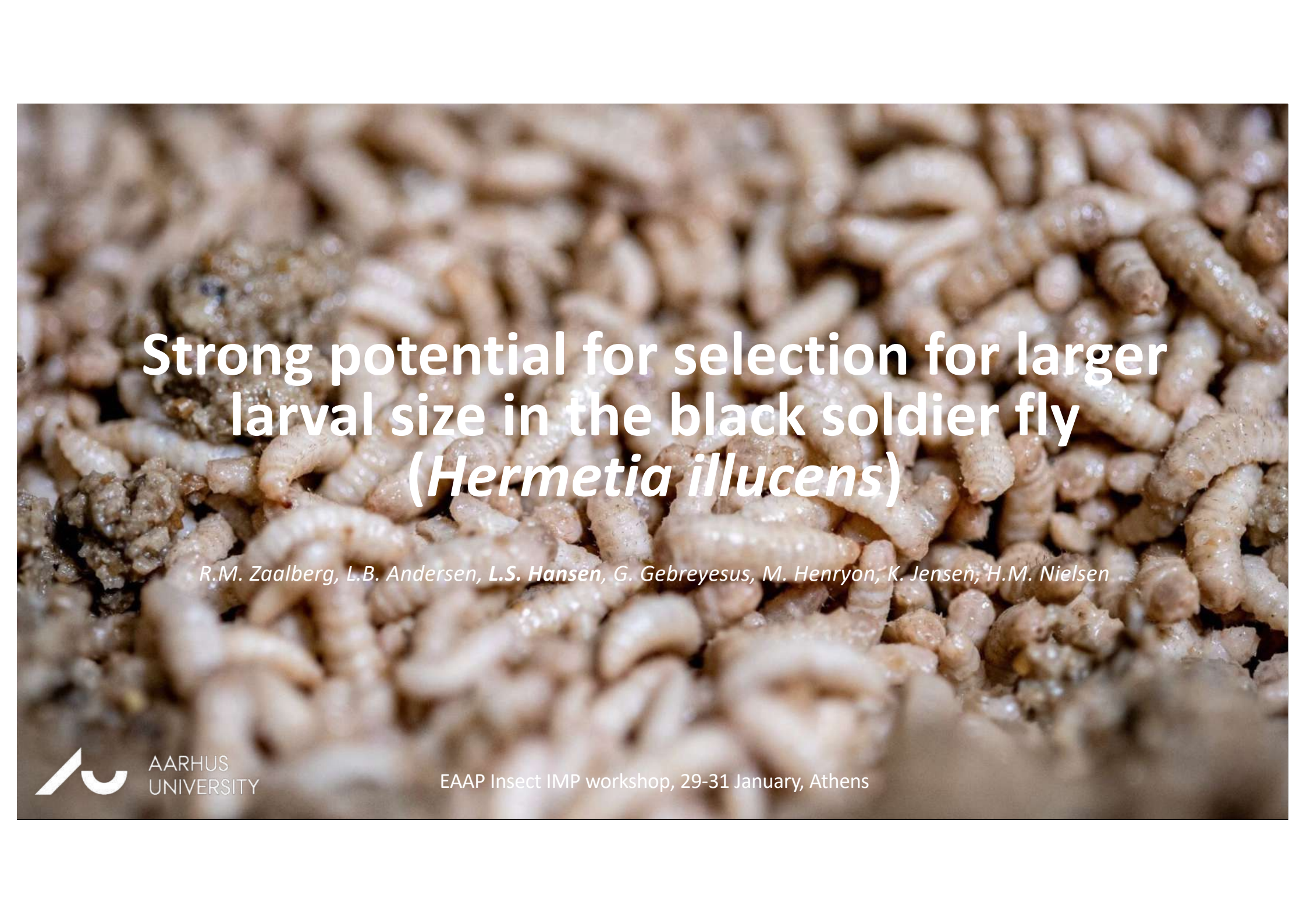




Strong potential for selection for larger larval size in the black soldier fly (*Hermetia illucens*)

R.M. Zaalberg, L.B. Andersen, L.S. Hansen, G. Gebreyesus, M. Henryon, K. Jensen, H.M. Nielsen



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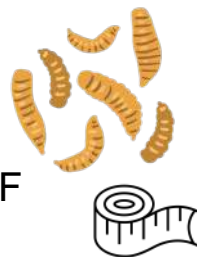
EAAP Insect IMP workshop, 29-31 January, Athens

Why estimate heritability?

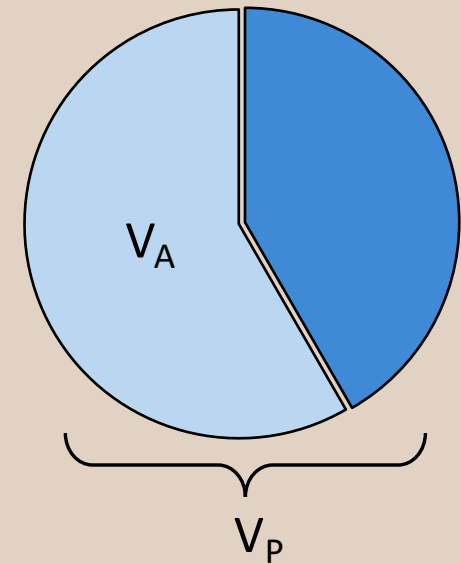
- Variance components are a key component of breeding
- Heritability h^2 will determine the best selection strategy
- Unveil if there is genetic variation for a trait
- Insights useful also for rearing and management

AIM

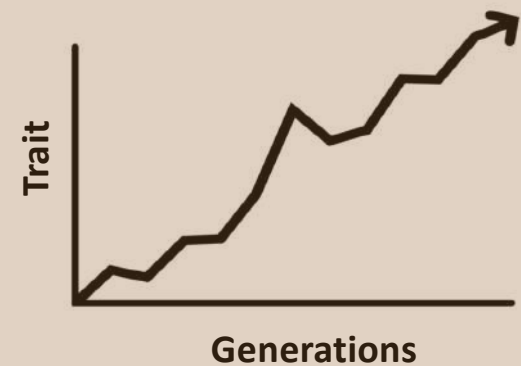
Estimate the heritability of larval size in BSF



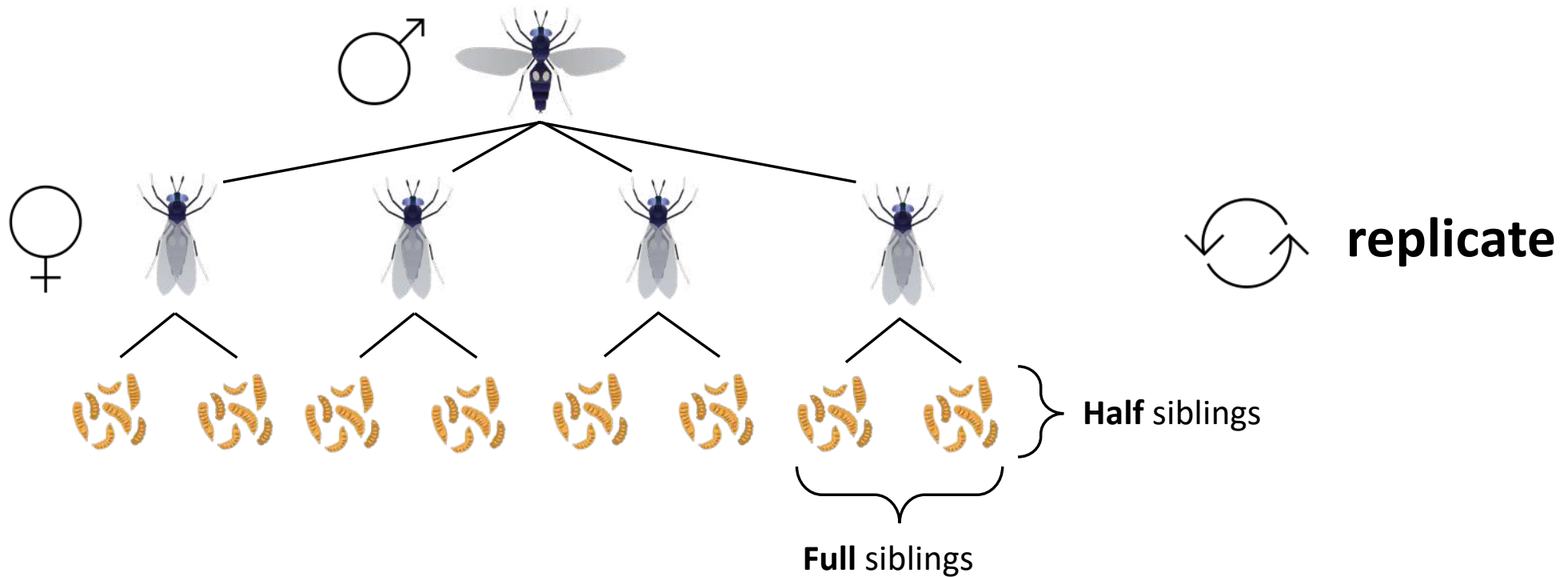
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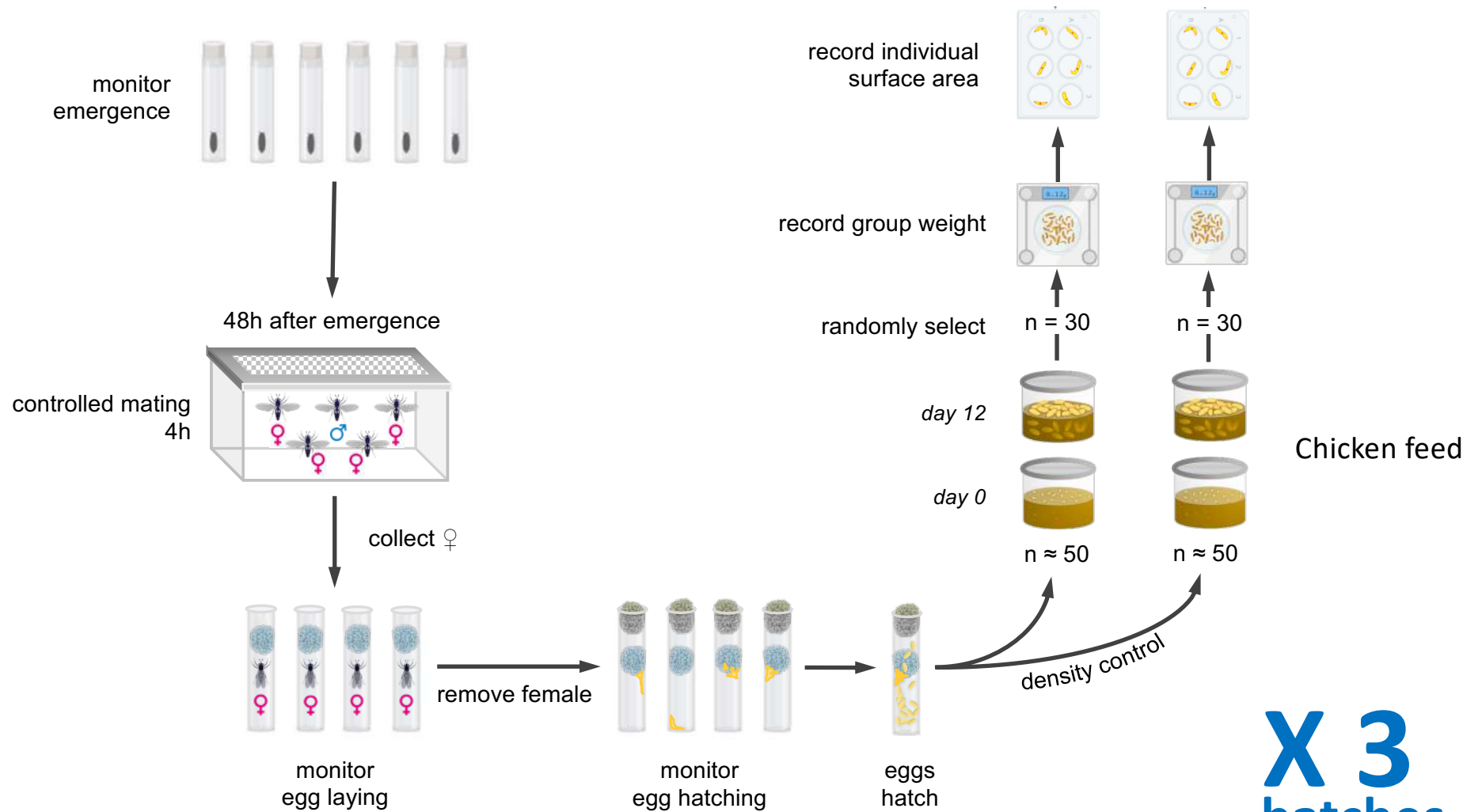
$$h^2 = \frac{V_A}{V_P}$$



Mating and generation of family groups



Experimental design

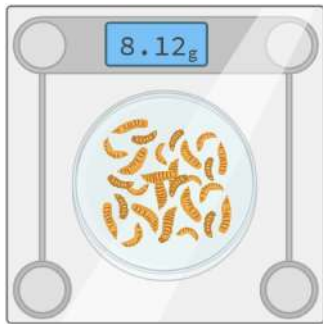


X 3
batches



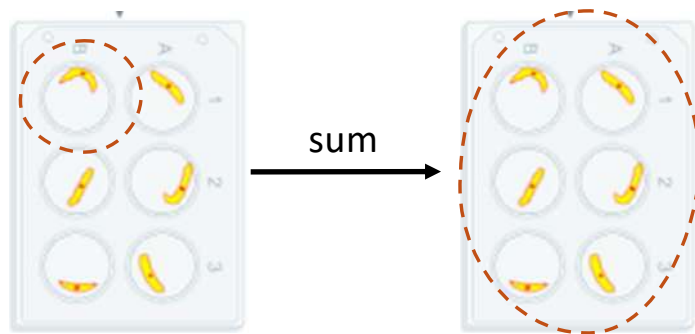
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Traits and phenotyping



Manual weighing

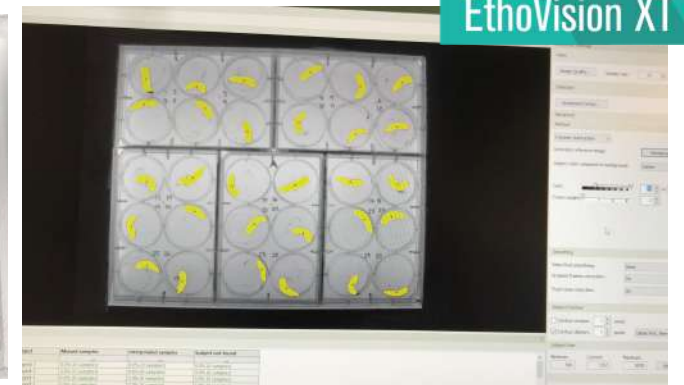
Group weight



*Individual
surface area*

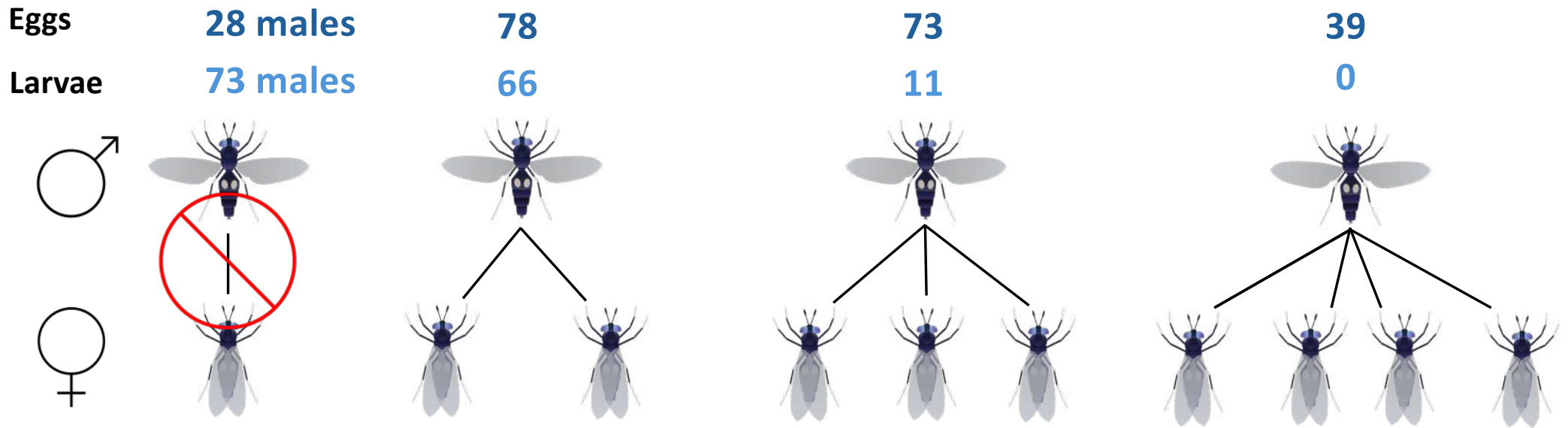
*Group
surface area*

Computer vision



Laursen et al. 2021

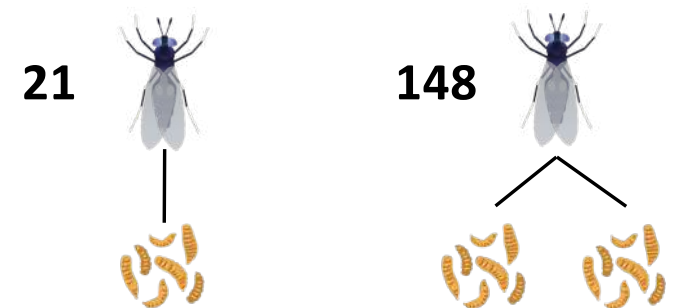
Mating success



559 females with eggs → 238 females with larvae → 181 measured → 169 used for analyses

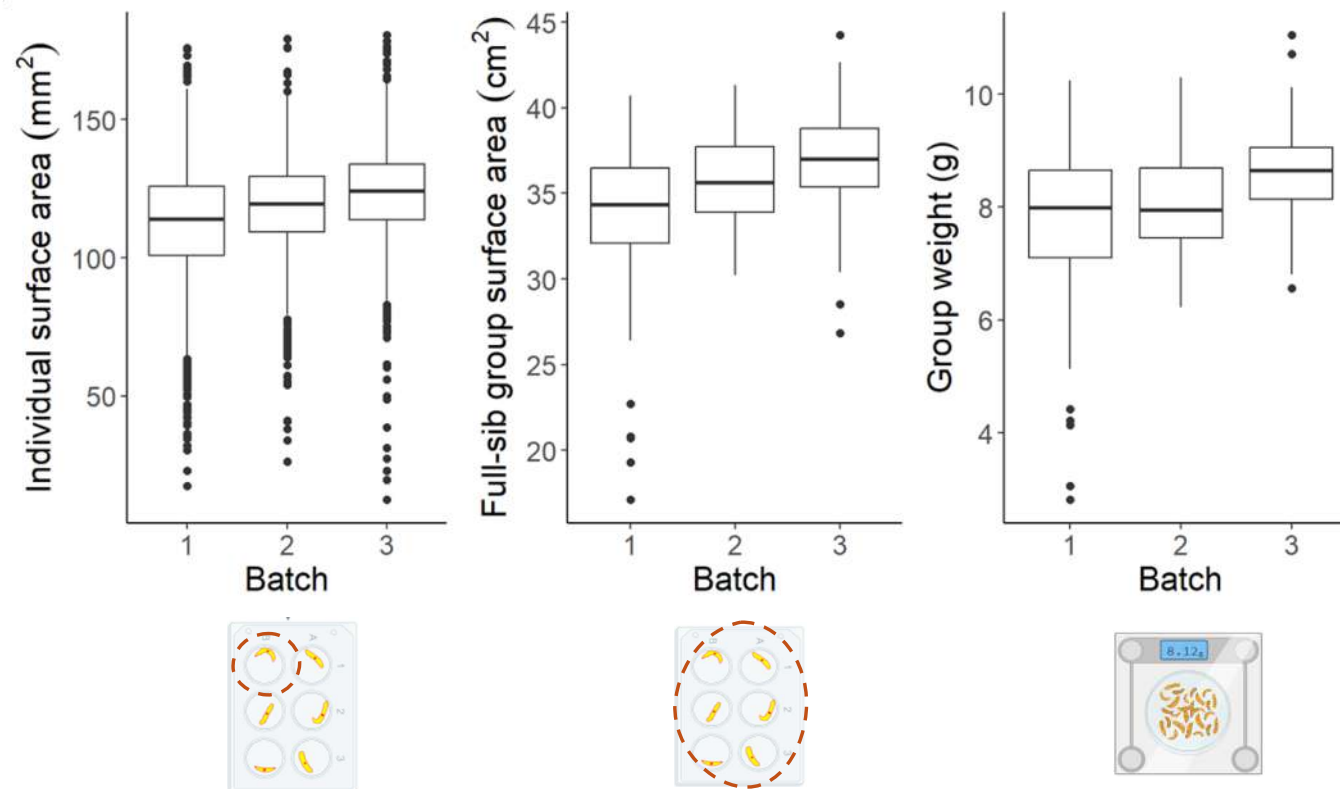
♂:♀

1:1 16 males
1:2 66 males
1:3 11 males



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Effect of batch on the three traits



Genetic models and calculations



Individual surface area = μ + batch + *sire* + *dam* + *cup* + *e*

$$h^2 = \frac{4\sigma_s^2}{\sigma_p^2}$$



Group traits = μ + batch + *sire* + *dam* + *e*

$$h^2 = \frac{4\sigma_s^2}{\sigma_s^2 + \sigma_d^2 + \sqrt{30} * \sigma_e^2}$$



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Heritability and common environment

Trait	Unit	h^2	c^2	σ_s^2	σ_d^2	σ_c^2	σ_e^2
Individual surface area	mm ²	0.40 (0.11)	0.21 (0.02)	29.1 (9.9)	11.0 (8.6)	60.4 (7.7)	191.2 (2.8)
Group surface area	cm ²	0.39 (0.12)	-	3.5 (1.1)	1.6 (0.8)	-	5.6 (0.6)
Group weight	g	0.30 (0.10)	-	0.29 (0.10)	0.15 (0.09)	-	0.61 (0.07)



Heritability and common environment

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Conclusion

- Strong potential for selection for larger BSF larvae
- h^2 estimates higher than previous findings in BSF (**Bouwman et al. 2022 and 2024**)
- c^2 align with previous findings in BSF, house fly and mealworm

Next steps

- Trait correlations
- Trait selection for breeding



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