GENETIC PARAMETERS FOR HOUSE FLY LARVAL PERFORMANCE IN TWO DIETARY ENVIRONMENTS

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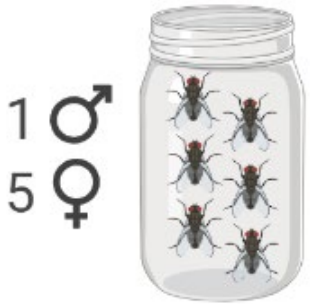
POPULATION

House fly
Musca domestica (Diptera)

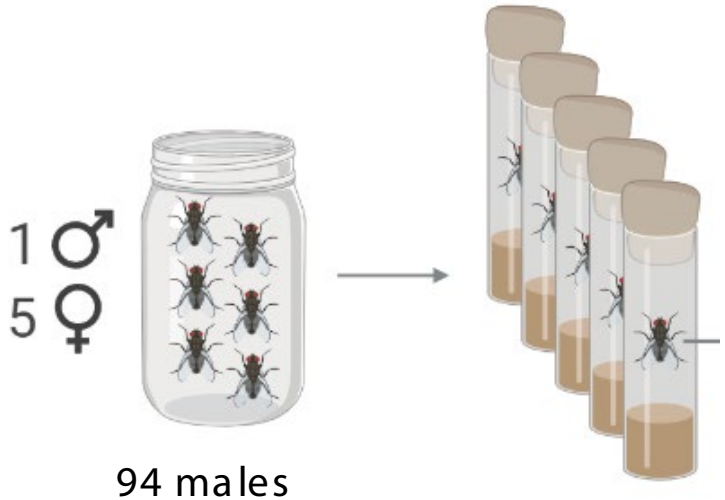
Population of **15,000** flies

Matings and families



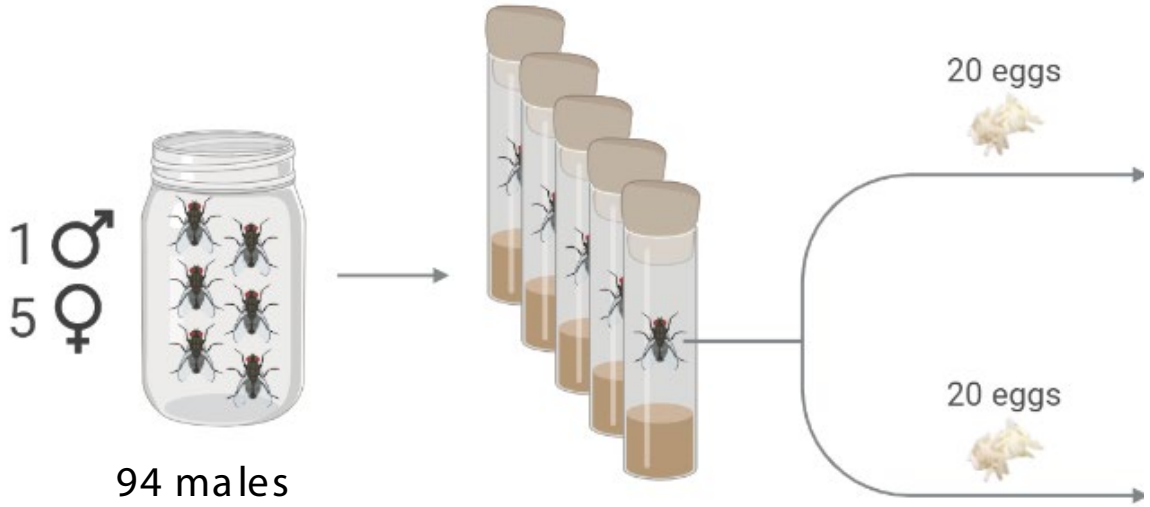
94 males
470 females

Matings and families



94 males
470 females

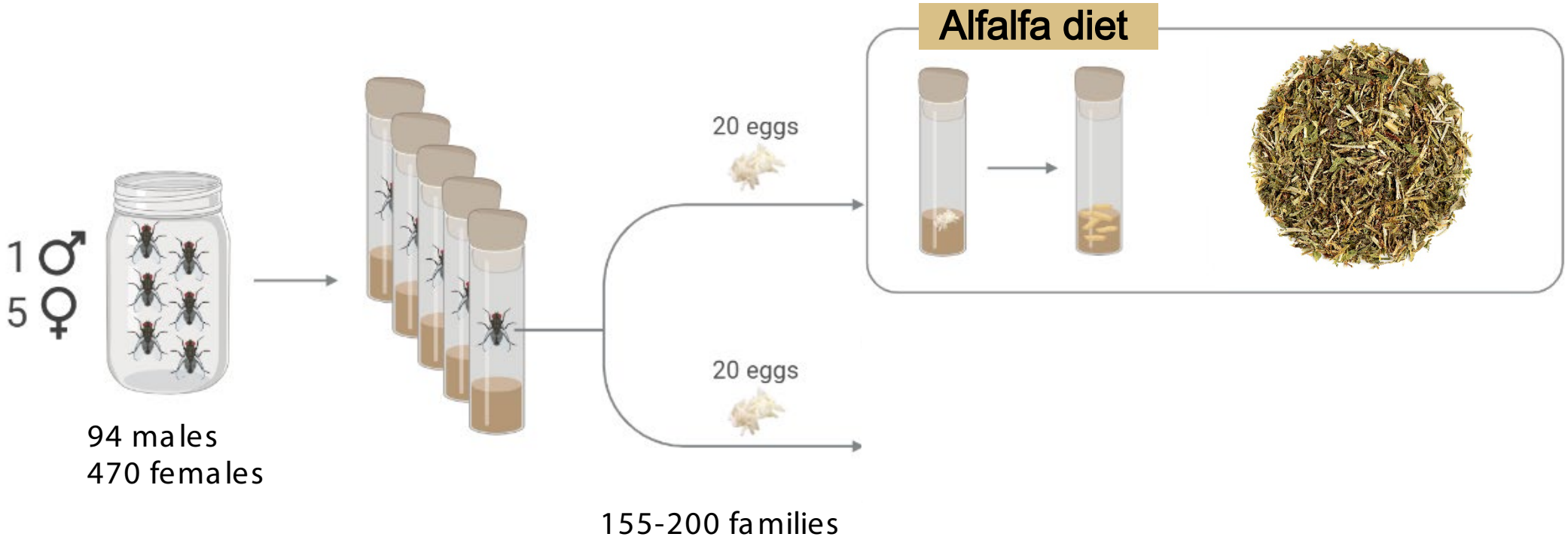
Matings and families



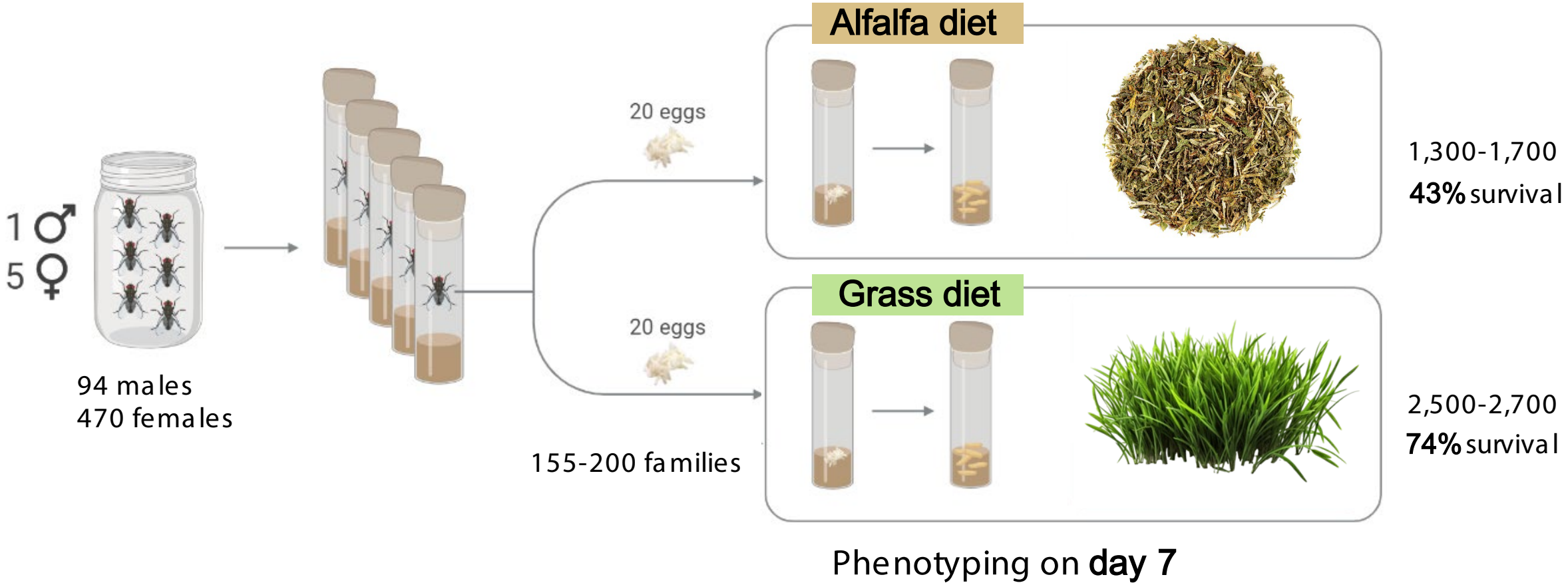
94 males
470 females

155-200 families

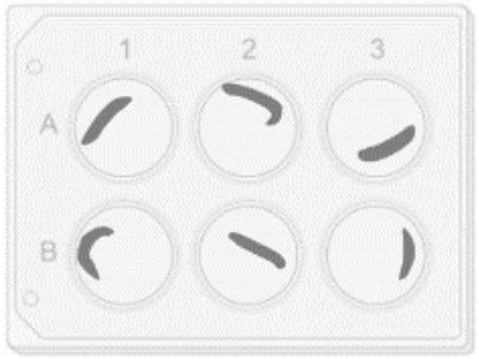
Matings and families



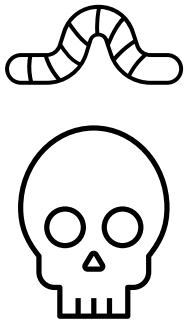
Matings and families



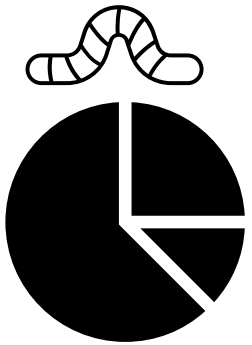
INDIVIDUALPHENOTYPING



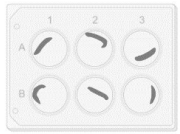
Larval **surface area**

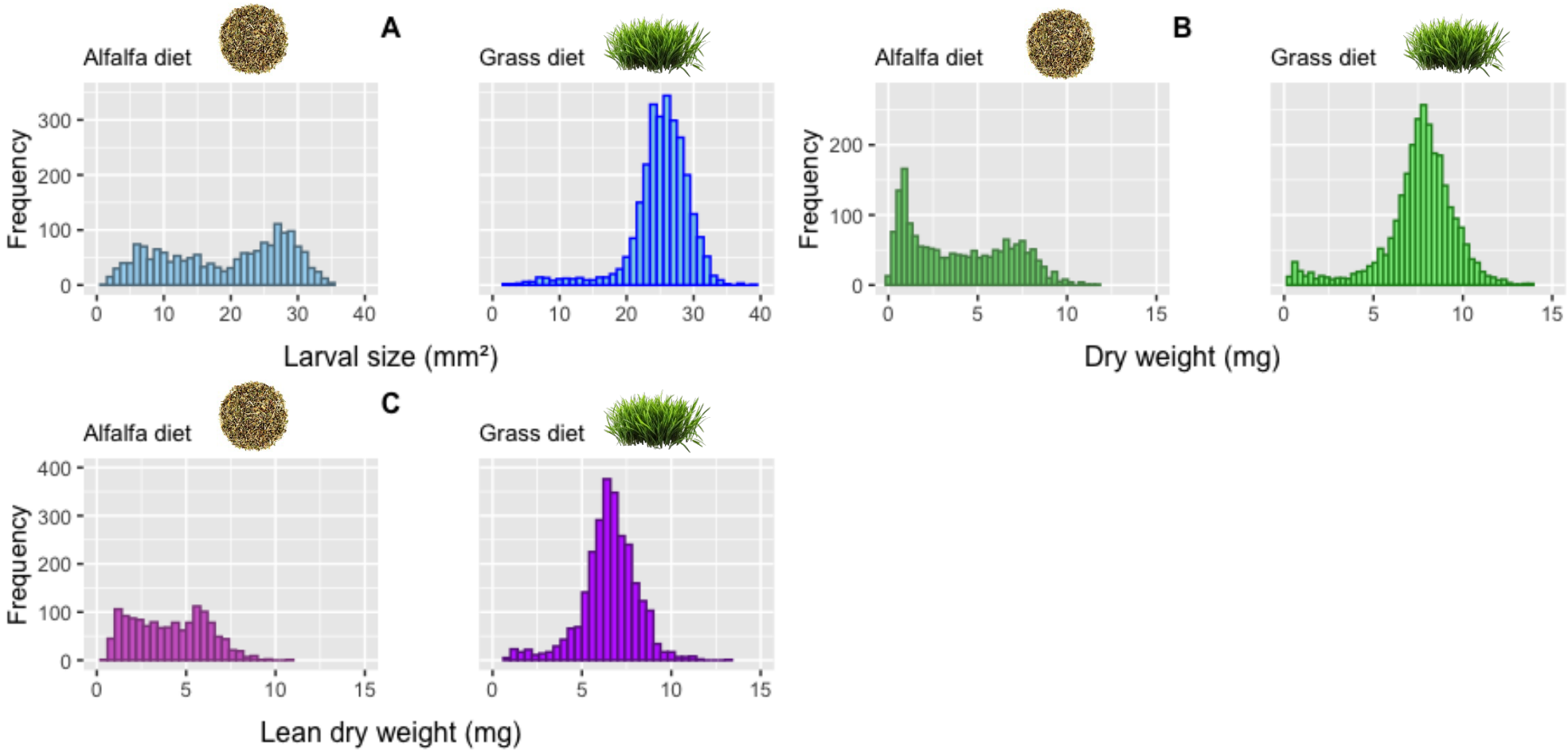


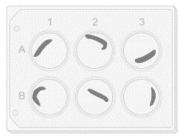
Larval **survival**

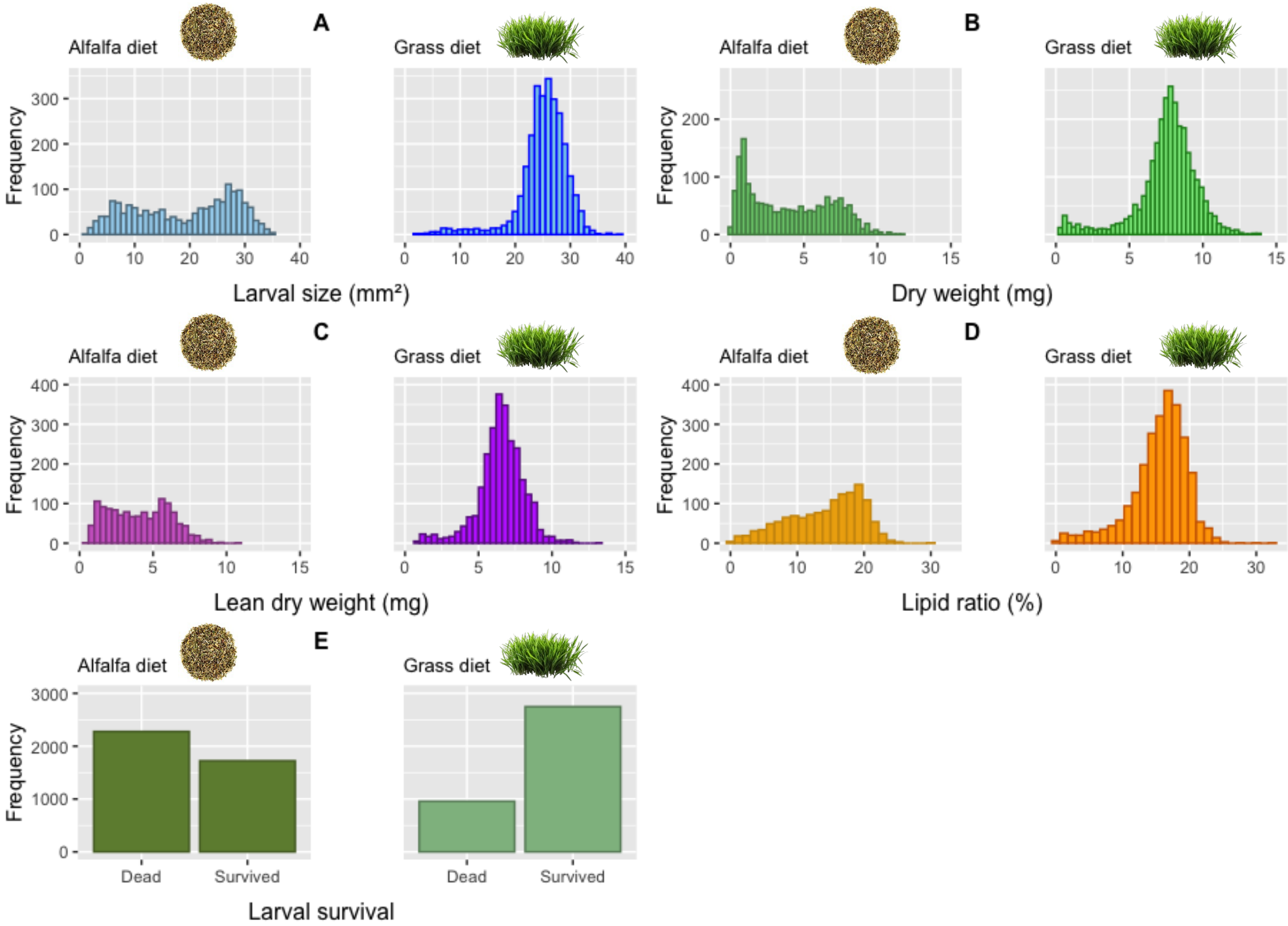


Larval **dry weight**
Larval **lipid content**
Larval **lean dry weight**




A
Alfalfa diet
Grass diet
Frequency
0
100
200
300
0
10
20
30
40
Larval size (mm²)
B
Alfalfa diet
Grass diet
Frequency
0
100
200
0
5
10
15
Dry weight (mg)
C
Alfalfa diet
Grass diet
Frequency
0
100
200
300
400
0
5
10
15
Lean dry weight (mg)




A
Alfalfa diet
Grass diet
Frequency
Larval size (mm²)
B
Alfalfa diet
Grass diet
Frequency
Dry weight (mg)
C
Alfalfa diet
Grass diet
Frequency
Lean dry weight (mg)
D
Alfalfa diet
Grass diet
Frequency
Lipid ratio (%)
E
Alfalfa diet
Grass diet
Frequency
Dead
Survived
Dead
Survived
Larval survival

GENETIC PARAMETERS

	σ^2_S	σ^2_C	σ^2_e	h^2 (SE)
Larval size (mm²)	1.62	32.18	30.20	0.10 (0.21)
Dry weight (mg)	0.18	2.87	3.31	0.12 (0.20)
Lean dry weight (mg)	0.13	1.82	1.98	0.13 (0.24)
Lipid (%)	1.16	7.71	19.70	0.16 (0.18)
Survival	0.004	0.04	0.17	0.07 (0.08)
Larval size (mm²)	2.20	6.40	12.90	0.41 (0.20)
Dry weight (mg)	-	-	-	-
Lean dry weight (mg)	-	-	-	-
Lipid (%)	0.59	6.76	11.50	0.13 (0.16)
Survival	-	-	-	-

Univariate mixed sire models with AI-REML in DMU software

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Survival	-	-	-	-

Large common environment effect

Univariate mixed sire models with AI-REML in DMU software

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Survival	-	-	-	-

4x higher h^2 for larval size on grass diet

Univariate mixed sire models with AI-REML in DMU software

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Dry weight (mg)	-	-	-	-
Lean dry weight (mg)	-	-	-	-
Lipid (%)	0.59	6.76	11.50	**0.13** (0.16)
Survival	-	-	-	-

Comparable h^2 for lipid (standard errors!)

Univariate mixed sire models with AI-REML in DMU software

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Lipid (%)	1.16	7.71	19.70	0.16 (0.18)
Survival	0.004	0.04	0.17	0.07 (0.08)
Larval size (mm²)	2.20	6.40	12.90	**0.41** (0.20)
Dry weight (mg)	1.05	-	3.65	**0.89** (0.023)
Lean dry weight (mg)	0.60	-	2.02	**0.92** (0.023)
Lipid (%)	0.59	6.76	11.50	**0.13** (0.16)
Survival	0.015	-	0.18	**0.31** (0.01)

Inflated estimates
False conclusions!

Univariate mixed sire models with AI-REML in DMU software

GENETIC CORRELATIONS

	Genetic / Phenotypic

	Larval size	Dry weight	Lean dry weight	Lipid %	Survival
Larval size		**0.90** (0.19)			
Dry weight	**0.91** (0.007)				
Lean dry weight					**0.25** (1.17)
Lipid %					**-0.78** (0.91)
Survival			**0.09** (0.04)	**0.08** (0.04)	
Larval size				**0.10** (0.54)	
Dry weight					
Lean dry weight					
Lipid %	**0.37** (0.03)				
Survival					

Bivariate mixed sire models with AI-REML in DMU software

GENETIC CORRELATIONS

	Genetic	Phenotypic

	Larval size	Dry weight	Lean dry weight	Lipid %	Survival
Larval size		0.90 (0.19)	0.96 (0.01)	0.84 (0.05)	0.33 (0.14)
Dry weight	0.91(0.007)		1.00 (0.00)	0.81 (0.06)	0.24 (0.14)
Lean dry weight	0.91 (0.01)	0.99 (0.00)		0.77 (0.07)	0.25 (1.17)
Lipid %	0.68 (0.02)	0.67 (0.02)	0.58 (0.03)		-0.78 (0.91)
Survival	0.06 (0.04)	0.16 (0.04)	0.09 (0.04)	0.08 (0.04)	
Larval size		0.87 (0.03)	0.87 (0.03)	0.10(0.54)	0.30 (0.14)
Dry weight	0.83 (0.01)		0.97 (0.01)	0.57 (0.09)	0.08 (0.15)
Lean dry weight	0.82 (0.01)	0.97 (0.00)		0.29 (0.13)	0.09 (0.15)
Lipid %	0.37 (0.03)	0.49 (0.03)	0.25 (0.03)		-0.06 (0.15)
Survival	0.05 (0.03)	0.01 (0.03)	0.01 (0.03)	-0.01 (0.03)	

Bivariate mixed sire models with AI-REML in DMU software (no common environment)

CONCLUSIONS AND NEXT STEPS

Main conclusions

h^2 estimates can be highly diet dependent

Feed will influence efficiency of phenotypic selection

Not accounting for environmental variance biases parameter estimates

Next steps

Correlate traits across environments for GxE estimation

ACKNOWLEDGEMENTS

UNIVERSITY OF COPENHAGEN

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INSECT-IMP

DANMARKS FRIE FORSKNINGSFOND
INDEPENDENT RESEARCH FUND DENMARK

Ingredients %	Alfalfa diet	Grass diet
Tap water	66.7	66.7
Wheat bran	21.3	21.3
Alfalfa	10.7	-
Deproteinated grass	-	10.7
Malt	0.8	0.8
Dry yeast	0.5	0.5

Chemical analysis		**Alfalfa diet**	**Grass diet**	Analysis method
Energy content	KJ/100g	1152	1113	Council Directive 90/496/EEC
Protein	%	19.1	20.3	Dumas Leco Nitrogen
Fat	%	1.7	1.8	NMR[1]
SFA[2]	%	0.52	0.52	BS/EN ISO 12966-2; 2011-ISO 5509:1990
Carbohydrates	%	68.8	66.8	Council Directive 90/496/EEC
Sugars	%	0.4	0.1	Commission Reg. (EC); 152/2009
Fibers	%	45	48.3	AOAC[3] 985.29
Ash	%	6.3	6.5	BS 4401 Part 1 1998 Com.; Reg. 152/2009
Sodium (Na)	%	0.0668	0.0221	ICP OES[4]
Water content	%	4.1	4.6	AOAC[3] 16 Ed.

	N	Sires	Dams	Mean	SD	Min	Max
Medium 1 - Alfalfa							
Larval size (mm²)	1722	73	184	18.97	9.11	1.30	35.13
Dry weight (mg)	1724	73	184	3.97	2.83	0.04	11.71
Lean dry weight (mg)	1362	69	156	4.10	2.05	0.57	10.79
Lipid (%)	1345	69	155	14.22	5.50	0	30.09
Lipid (mg)	1342	69	155	0.78	0.55	0.01	2.85
Survival	3999	74	200	0.43	0.28[1]	0	1
Medium 2 –Grass							
Larval size (mm²)	2746	74	189	25.07	4.53	1.52	39.46
Dry weight (mg)	2741	74	189	7.54	2.10	0.17	13.70
Lean dry weight (mg)	2674	74	189	6.53	1.57	0.96	13.09
Lipid (%)	2575	74	189	15.49	4.27	0	32.02
Lipid (mg)	2574	74	189	1.22	0.49	0.01	3.90
Survival	3703	74	190	0.74	0.22[1]	0	1