SIMULATING BREEDING PROGRAMS BASED ON MASS SELECTION IN BLACK SOLDIER FLY

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INTRODUCTION

Black soldier fly production for feed

Genetic improvement → larval body weight?

Mass selection (phenotypes)

How much labor should we invest in a mass selection breeding program?

THIS STUDY

Aim

Compare different mass selection breeding programs that differ in terms of manual labor, to improve larval bodyweight (LBW)

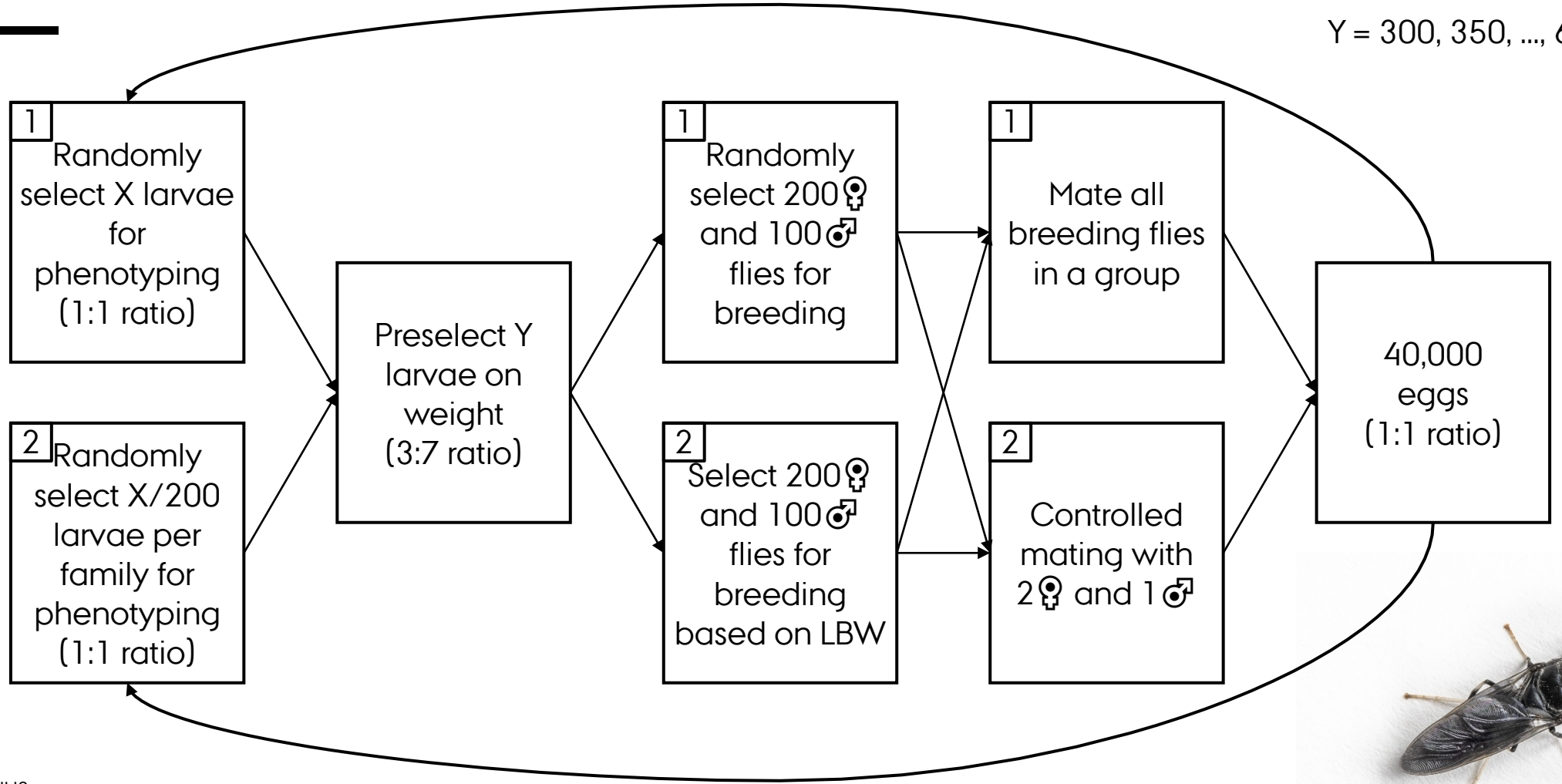
Set up

Stochastic simulation with different breeding scheme designs and different numbers of animals phenotyped and preselected

BREEDING SCHEME DESIGN

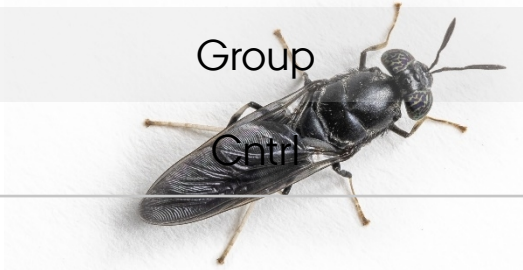
X = 400, 1000, 2000, ..., 10,000

Y = 300, 350, ..., 600



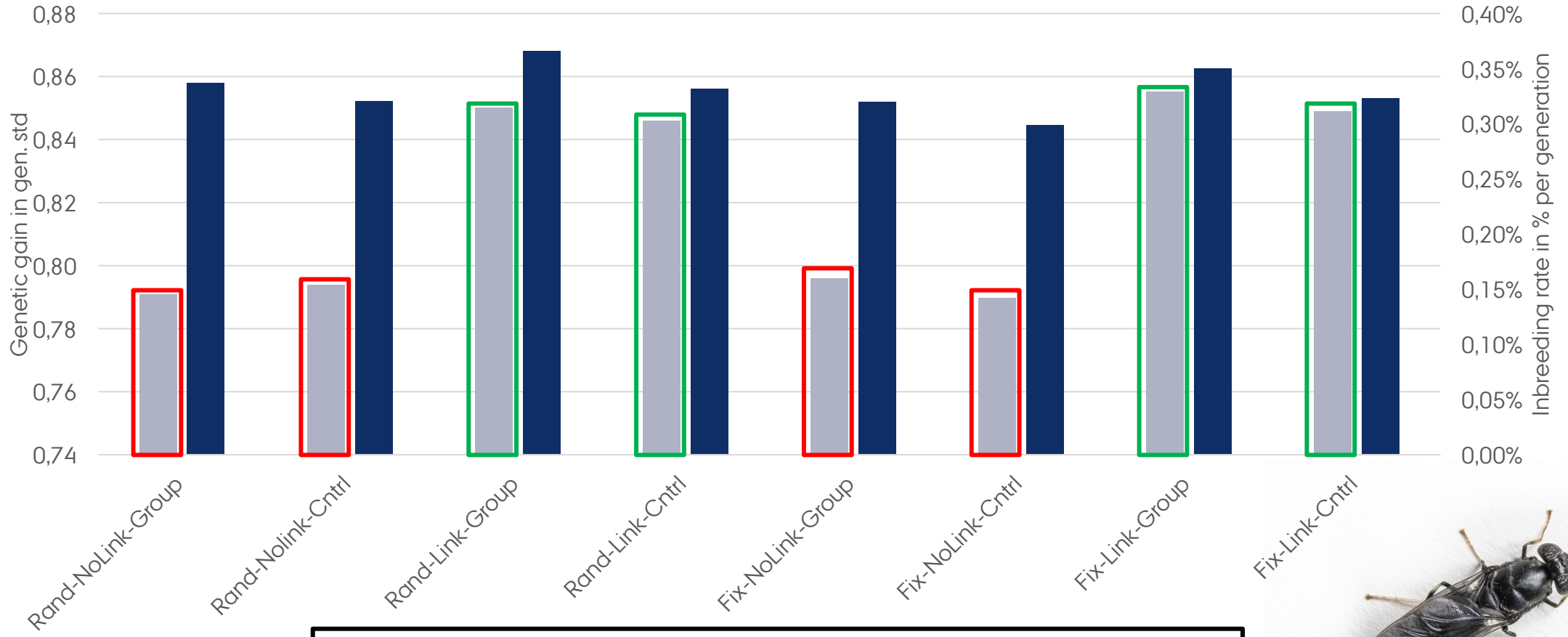
BREEDING SCHEME DESIGN

Name breeding scheme	Selection of larvae for phenotyping step	Phenotype for LBW linked to adult fly	Mating in group or controlled with 2 females and 1 male
Rand-NoLink-Group	Random	Not linked	Group
Rand-NoLink-Cntrl	Random	Not linked	Cntrl
Rand-Link-Group	Random	Linked	Group
Rand-Link-Cntrl	Random	Linked	Cntrl
Fix-NoLink-Group	Fixed number per family	Not linked	Group
Fix-NoLink-Cntrl	Fixed number per family	Not linked	Cntrl
Fix-Link-Group	Fixed number per family	Linked	Group
Fix-Link-Cntrl	Fixed number per family	Linked	Cntrl



EFFECT OF BREEDING SCHEME

No preselected = 400
No phenotyped = 3000



Breeding schemes with linked phenotype highest genetic gain: +7-8%

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EFFECT OF BREEDING SCHEME

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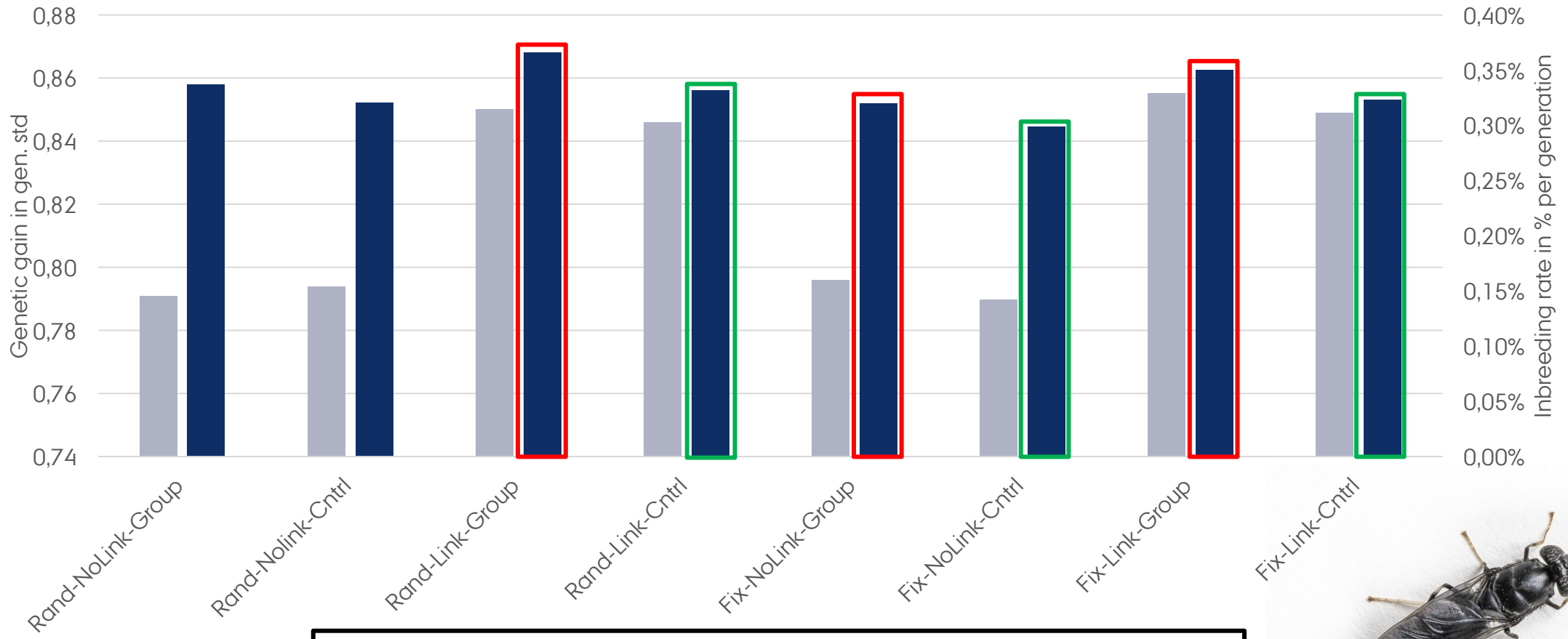
No phenotyped = 3000



Controlled mating compared to in a group reduces inbreeding

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EFFECT OF BREEDING SCHEME

No preselected = 400
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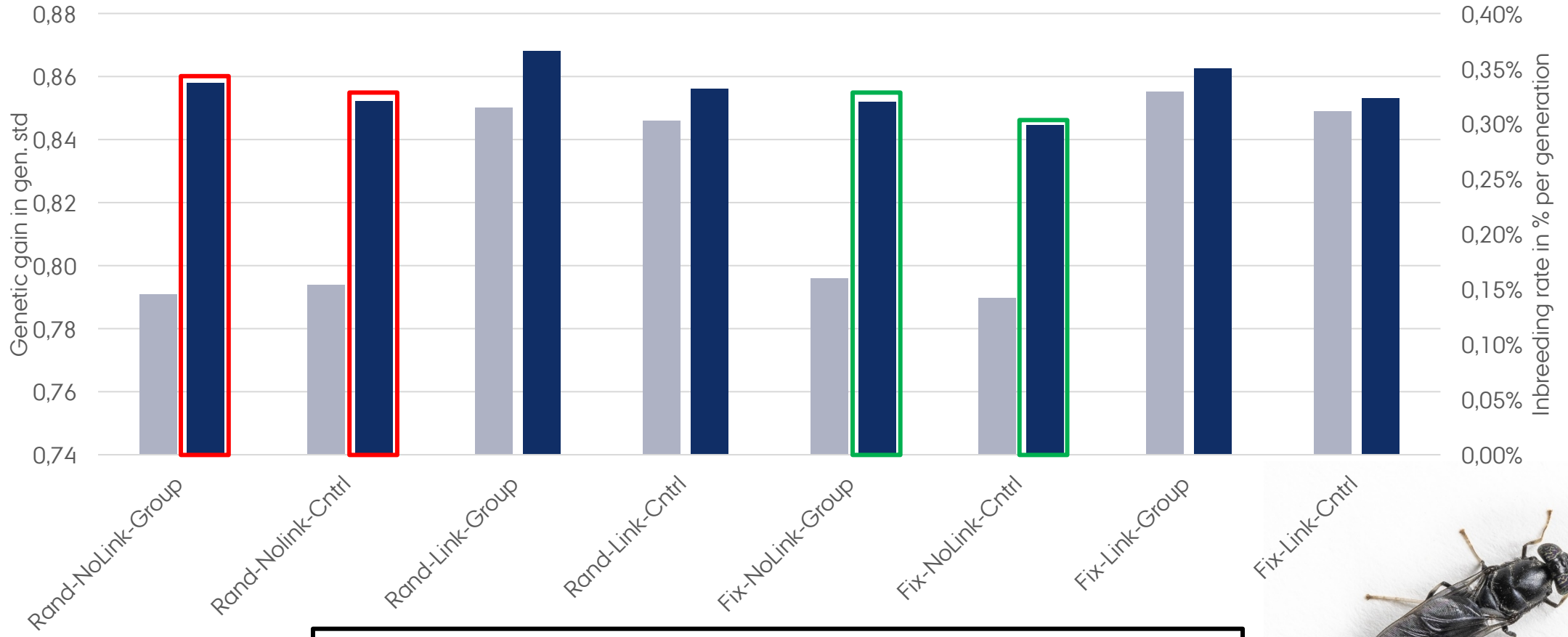

Phenotyping fixed number of larvae per family
small effect on inbreeding

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EFFECT OF BREEDING SCHEME

1. Phenotyping fixed number of larvae per family small effect on inbreeding

2. Breeding schemes with linked phenotype highest genetic gain

3. Controlled mating compared to in a group reduces inbreeding

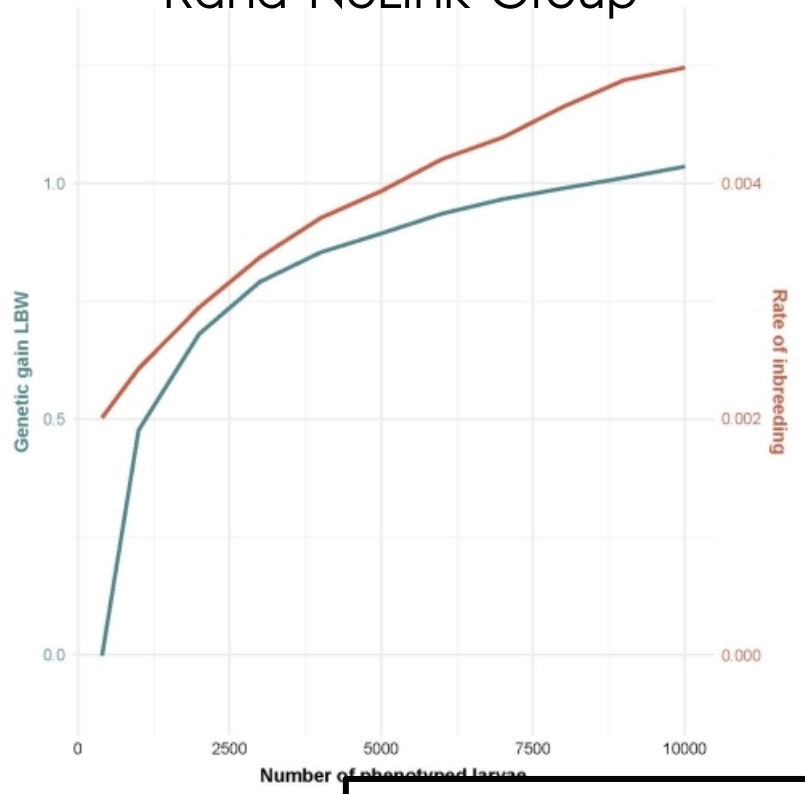
➢ Best breeding scheme would be Fix-Link-Cntrl

+7% genetic gain / -4% inbreeding compared to Rand-NoLink-Group

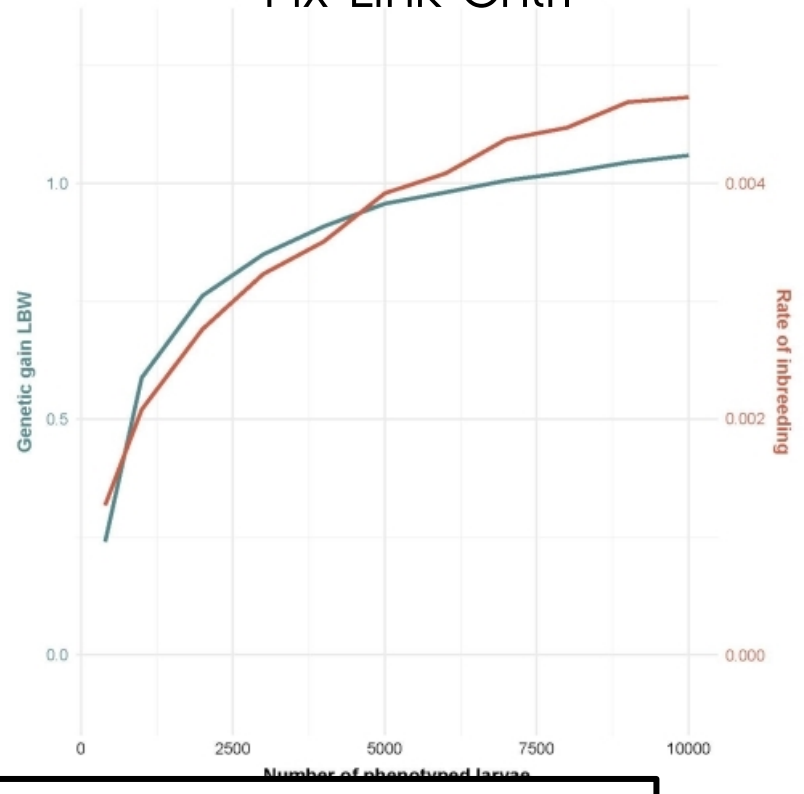
EFFECT OF NUMBER PHENOTYPED

No preselected = 400

Rand-NoLink-Group



Fix-Link-Cntrl



Phenotyping more larvae increases genetic gain and

Phenotyping more than 8,000 larvae not useful

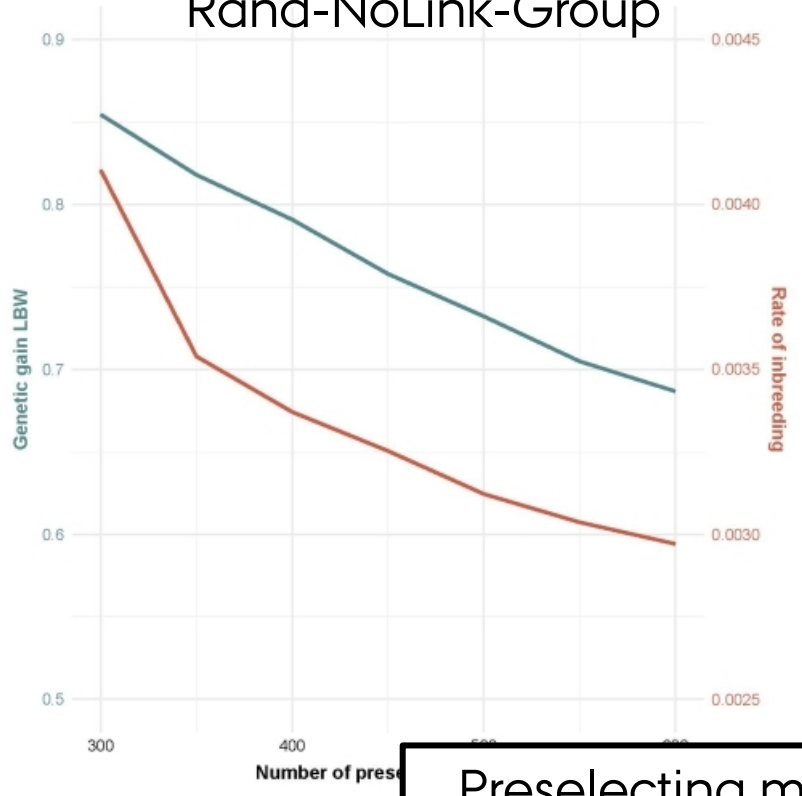
EFFECT OF NUMBER PHENOTYPED

	Genetic gain LBW		Inbreeding	
No. phenotyped	Rand-NoLink-Group	Fix-Link-Cntrl	Rand-NoLink-Group	Fix-Link-Cntrl
400	0.00	0.24	0.20%	0.13%
1,000	0.48	0.59	0.24%	0.21%
2,000	0.68	0.76	0.29%	0.28%
3,000	0.79	0.85	0.34%	0.32%
4,000	0.85	0.91	0.37%	0.35%
5,000	0.89	0.96	0.39%	0.39%
6,000	0.94	0.98	0.42%	0.41%
7,000	0.97	1.01	0.44%	0.44%
8,000	0.99	1.02	0.46%	0.45%
9,000	1.01	1.04	0.49%	0.47%
10,000	1.04	1.06	0.50%	0.47%

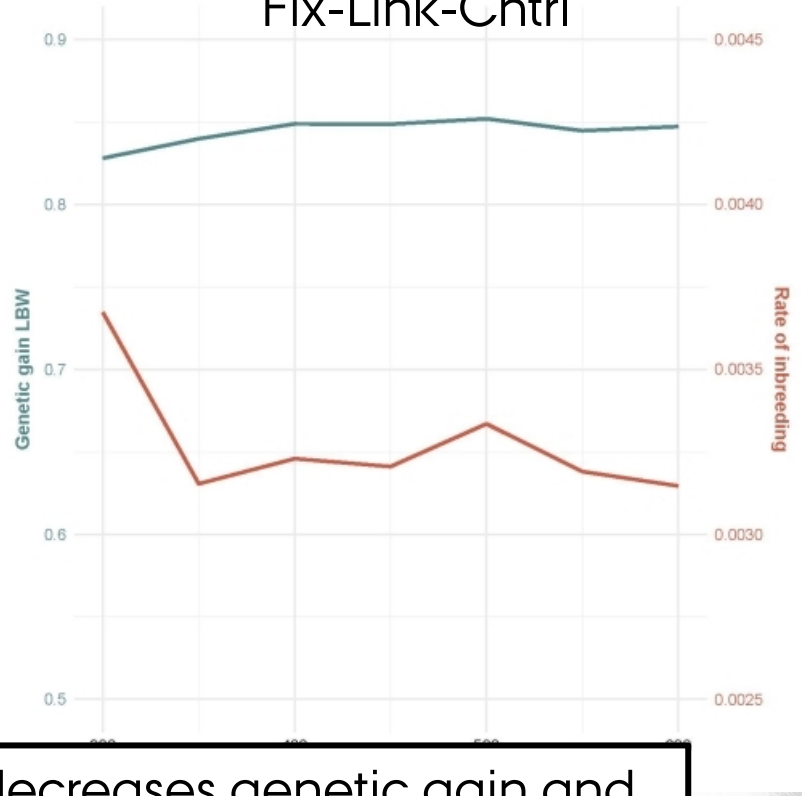
EFFECT OF NUMBER PRESELECTED

No phenotyped = 3000

Rand-NoLink-Group



Fix-Link-Cntrl



Preselecting more larvae decreases genetic gain and inbreeding in -NoLink- scenarios due to random selection afterwards

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CONCLUSIONS

Do more labor-intensive breeding programs increase genetic gain and decrease inbreeding? → Yes

Best breeding scheme would be Fix-Link-Cntrl

Phenotyping more increases genetic gain but also inbreeding

Female deviation for weight influences required no phenotyped and preselected

ACKNOWLEDGEMENTS

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FLYBREED

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CENTER FOR QUANTITATIVE GENETICS AND GENOMICS

QUESTIONS?