FLYgene

Advancing Sustainable Breeding Programs and Genomic Tools for BSF in Kenya and Uganda

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https://qgg.au.dk/en/research/projects/current-projects/flygene

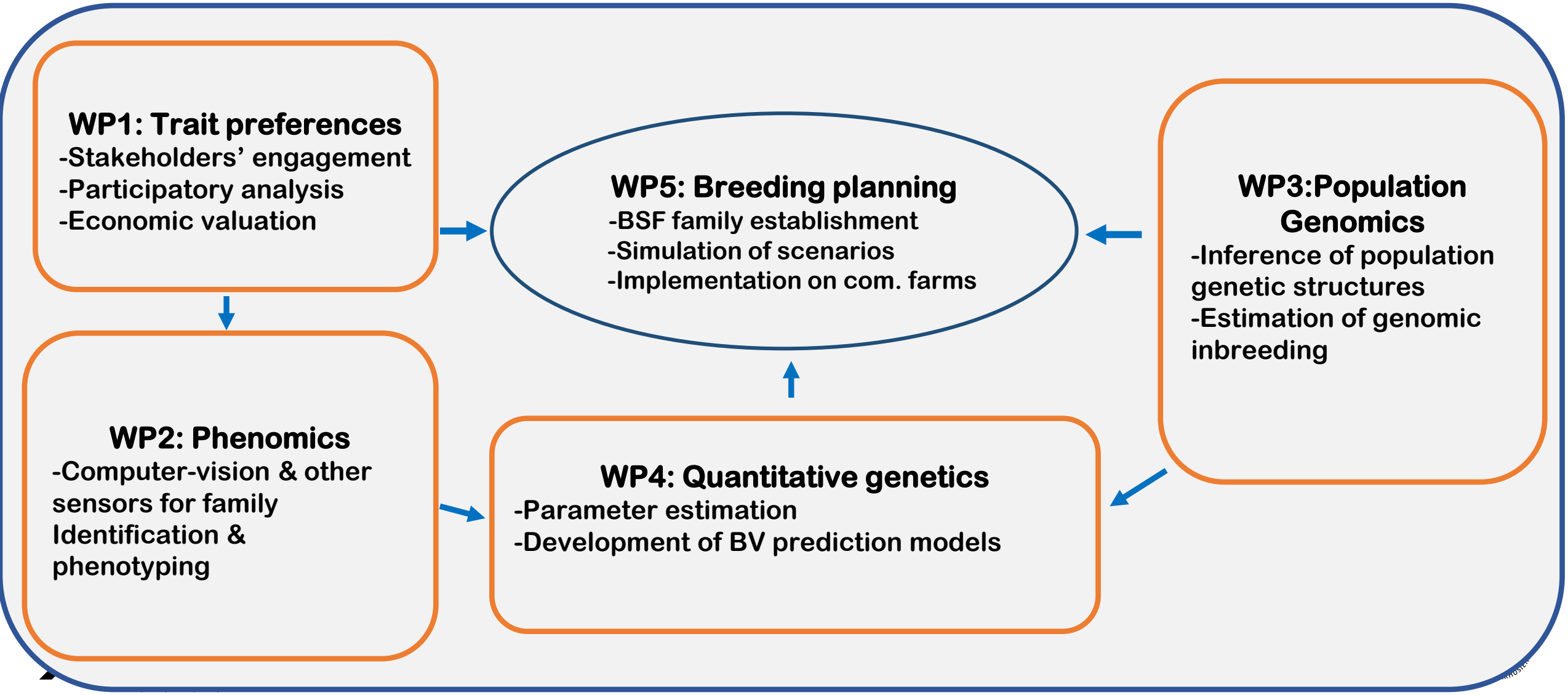
Aim and objectives

Implement BSF selective breeding targeting both large-scale producers and smallholder farmers in Kenya and Uganda

Objectives

1. Develop innovative large-scale phenotyping and rapid BSF family identification systems
2. Develop genomic tools for genetic marker-based monitoring of BSF genetic diversity and tracing of pedigree
3. Design breeding programs for BSF on both the large-scale producers as the nucleus farms, as well the smallholder farms as the multipliers and commercial producers
4. Physical and human capacity building in Kenya and Uganda in BSF breeding

Work packages



WP1: Stakeholder engagement and trait preferences

Prioritization needed

- What do BSF producers want?
- What do users want improved?

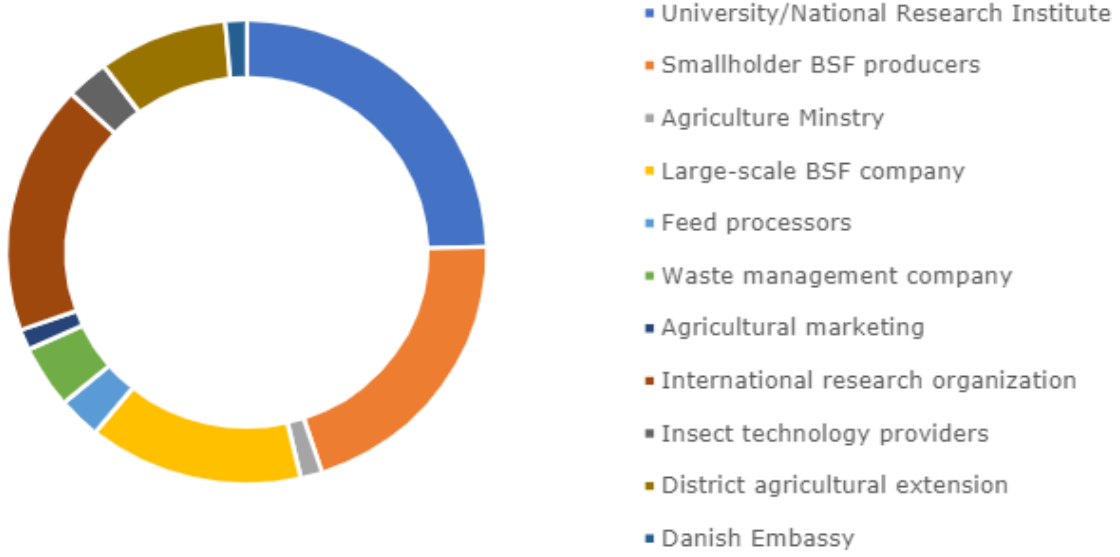
Stakeholder engagements

- Stakeholder mapping
- National stakeholder engagement meetings (Nairobi and Kampala)

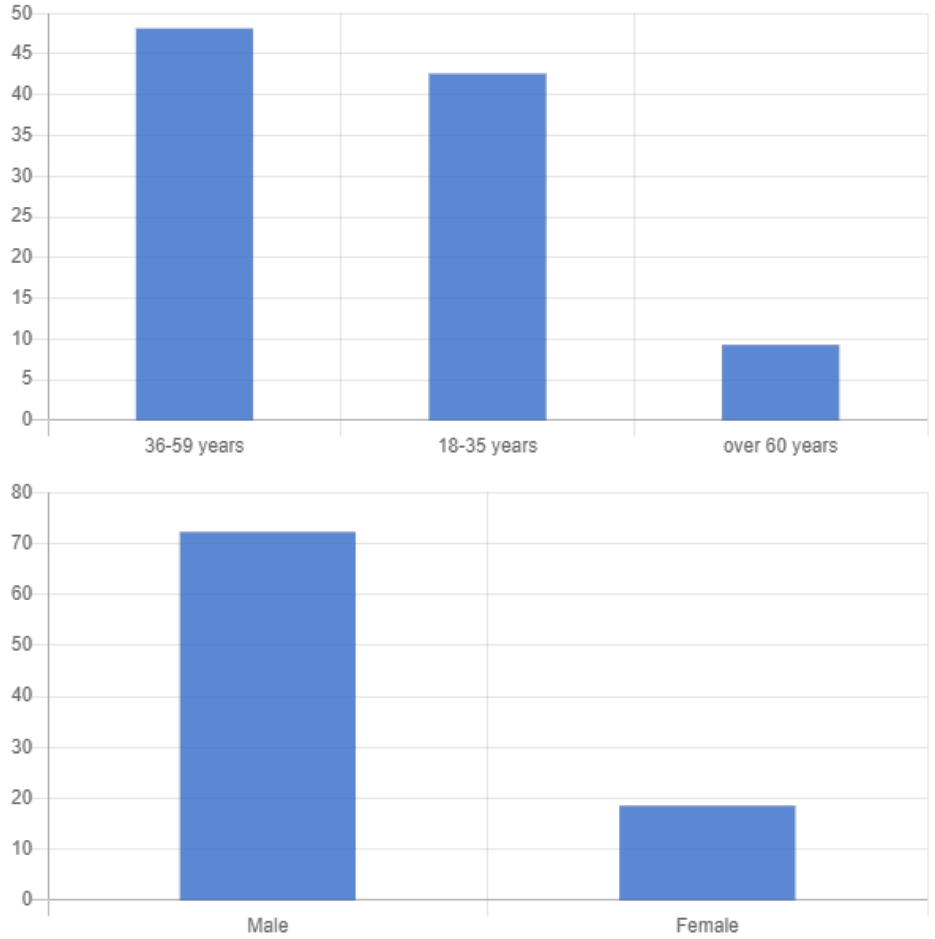
Participatory trait definition

- Choice experiments
- Bio-economic modelling

WP1: Stakeholder engagement and trait preferences



Diverse stakeholder representation



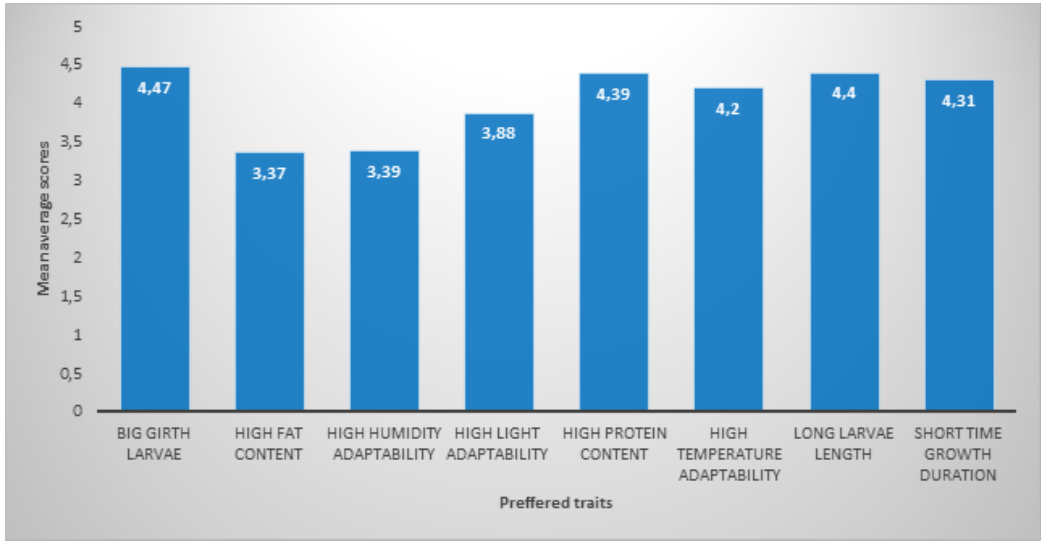
Smallholder BSF dominated by the young and male entrepreneurs

WP1: Stakeholder engagement and trait preferences

Trait preferences varied according to production system

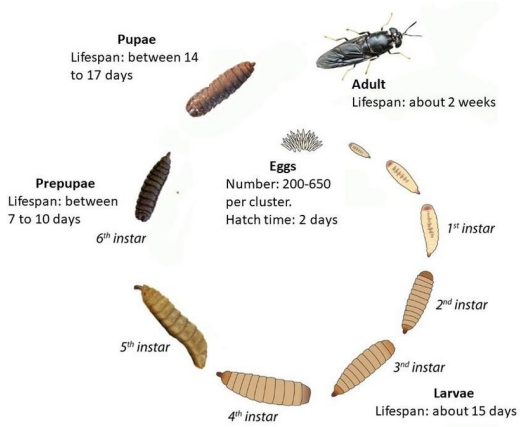
Industry scale producers:- protein content, feed utilization

Smallholders: Adaptation traits (temperature, humidity)



WP2: Phenotyping - Measurement challenges

Small size

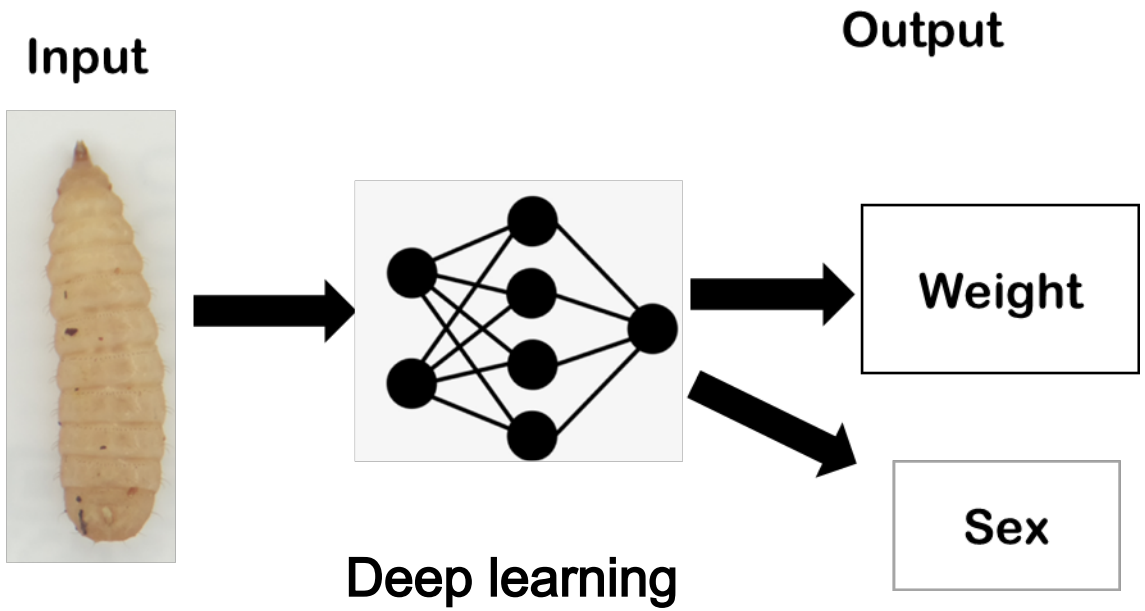


Life cycle

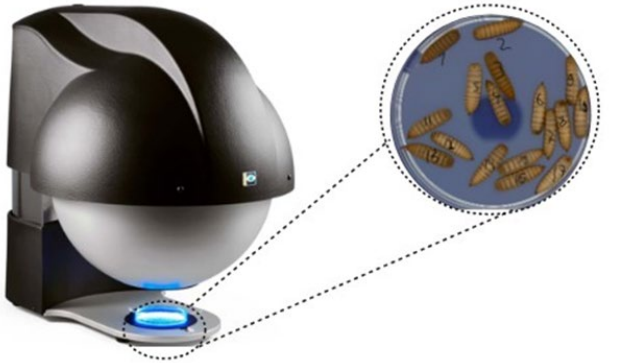
Dense population

Innovative measurement techniques

Computer vision & Deep learning

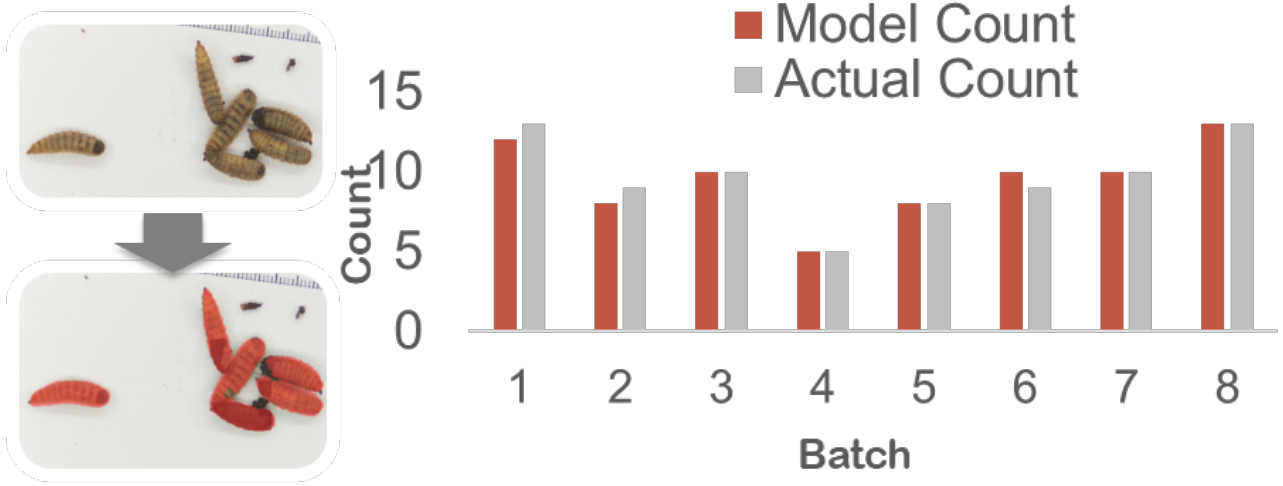


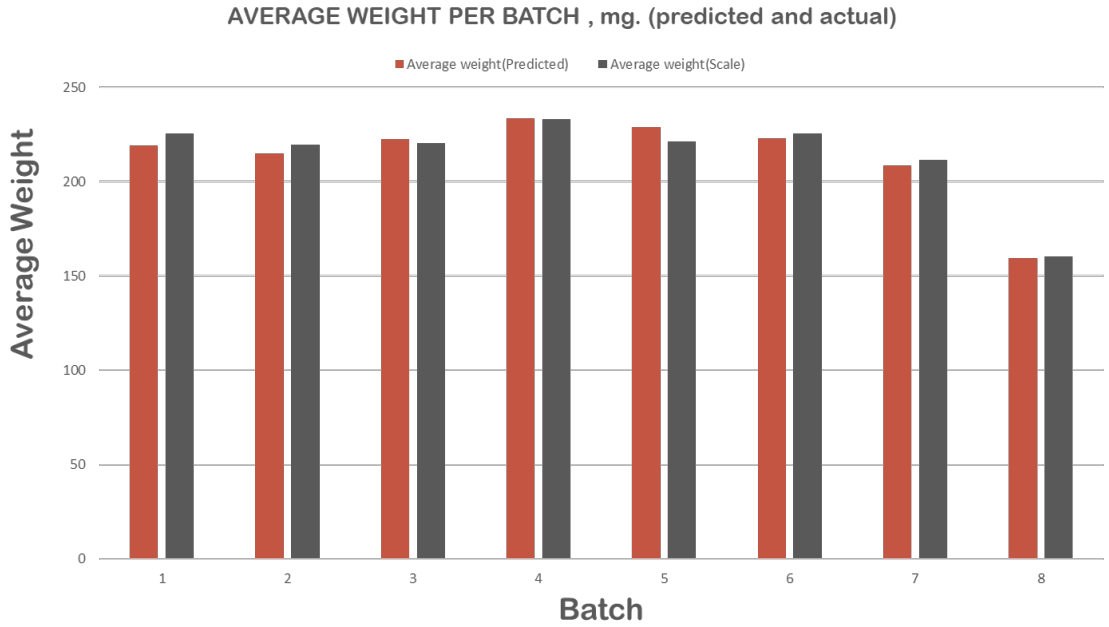
Hyperspectral imaging



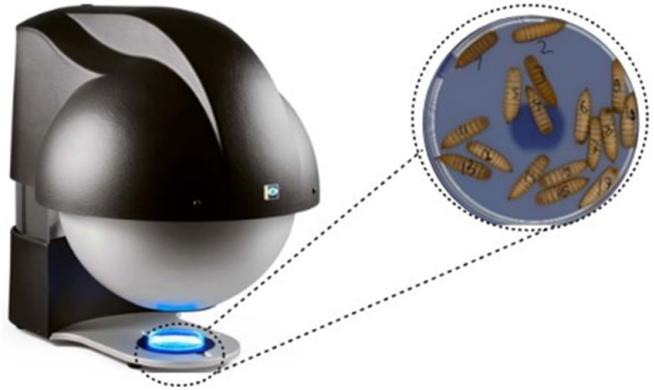
Protein and fat content from live larva

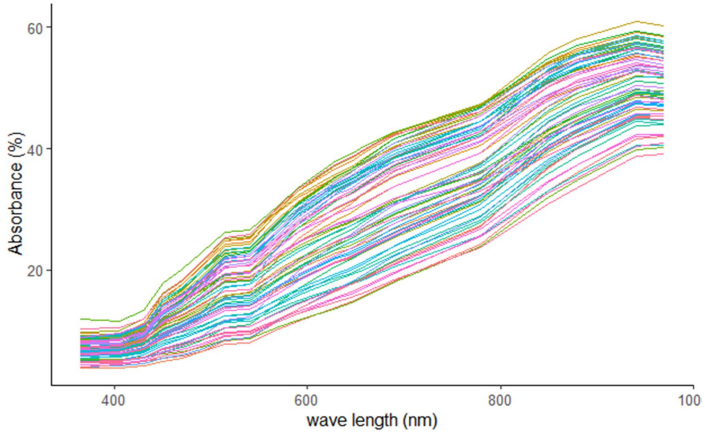
Computer-vision based approach for larval counting, weight prediction and sex classification

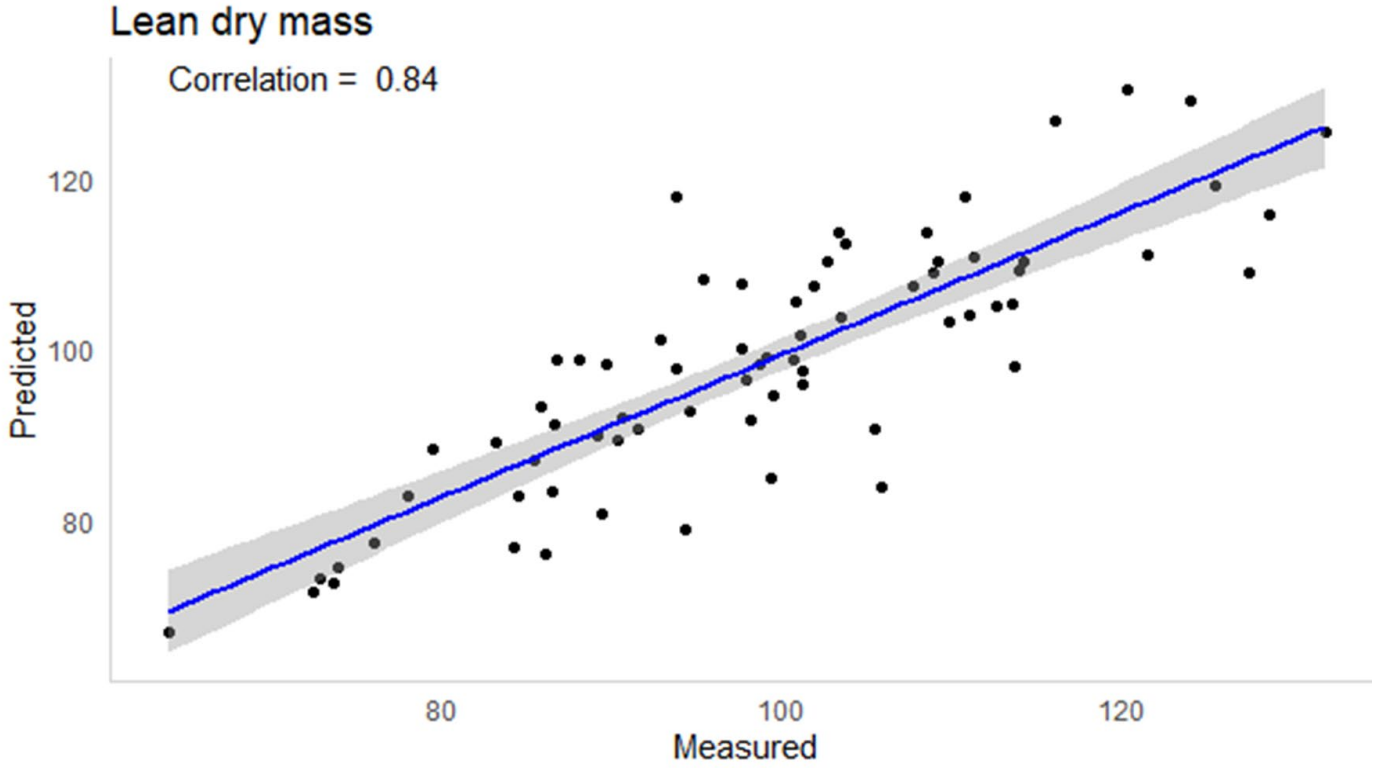




Spectral imaging for prediction of BSF larvae nutritional content







WP3: Population genetics

BSF population sampling

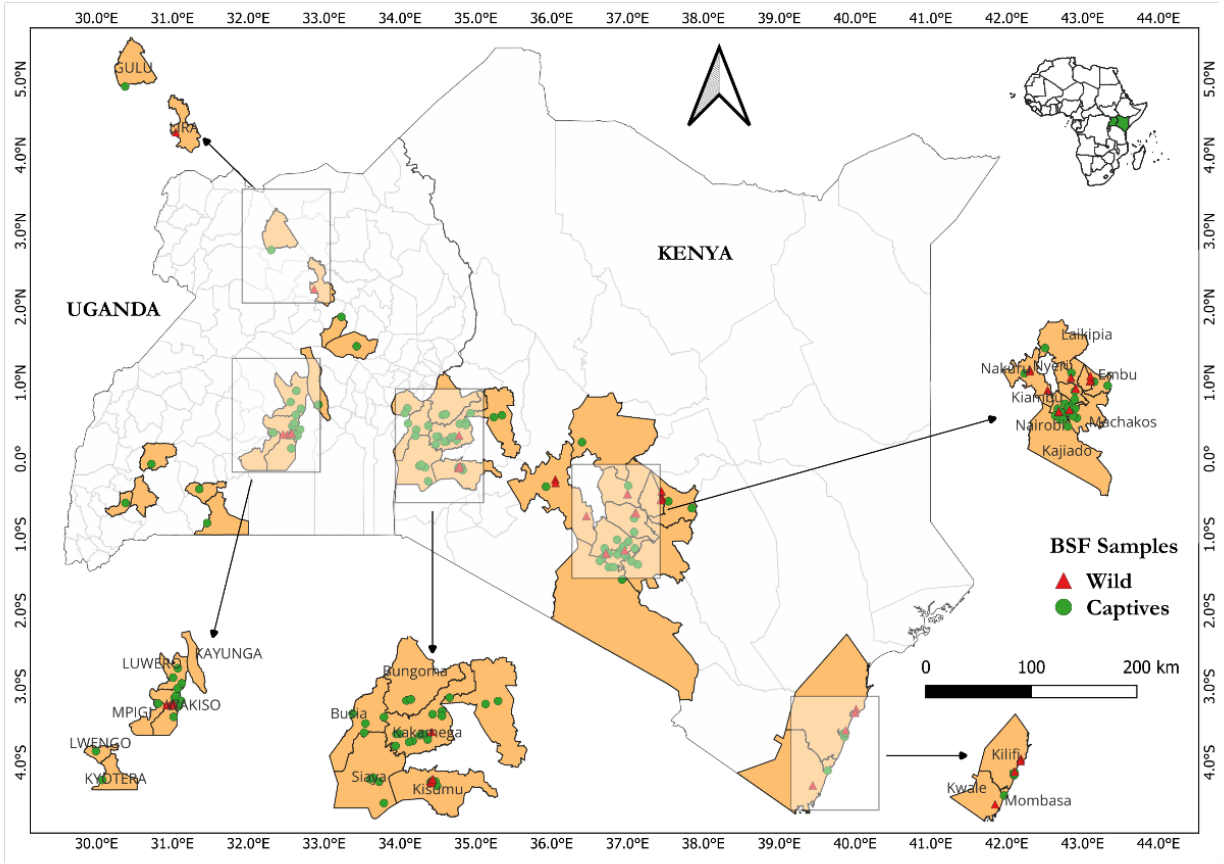
Three agroecological zones

Target both captive and wild BSF

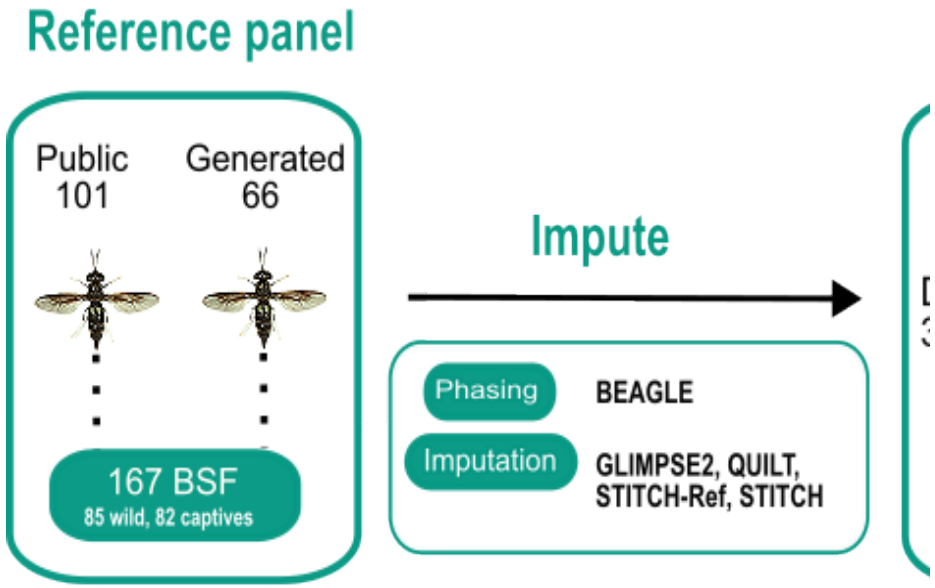
Data from Online Repositories:

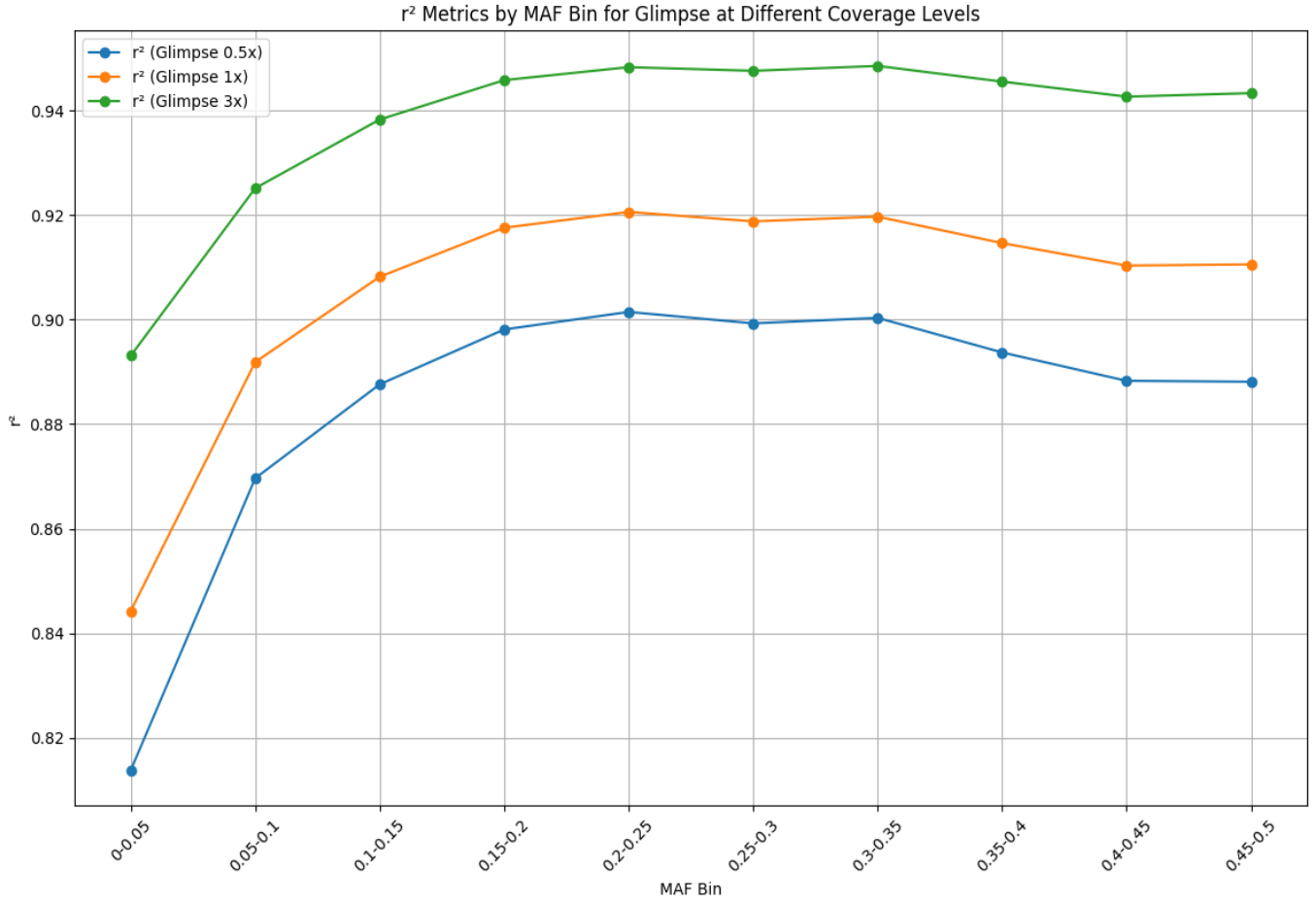
North America, South America

Asia, Australia, Europe, Africa



BSF Whole Genome Reference Panel



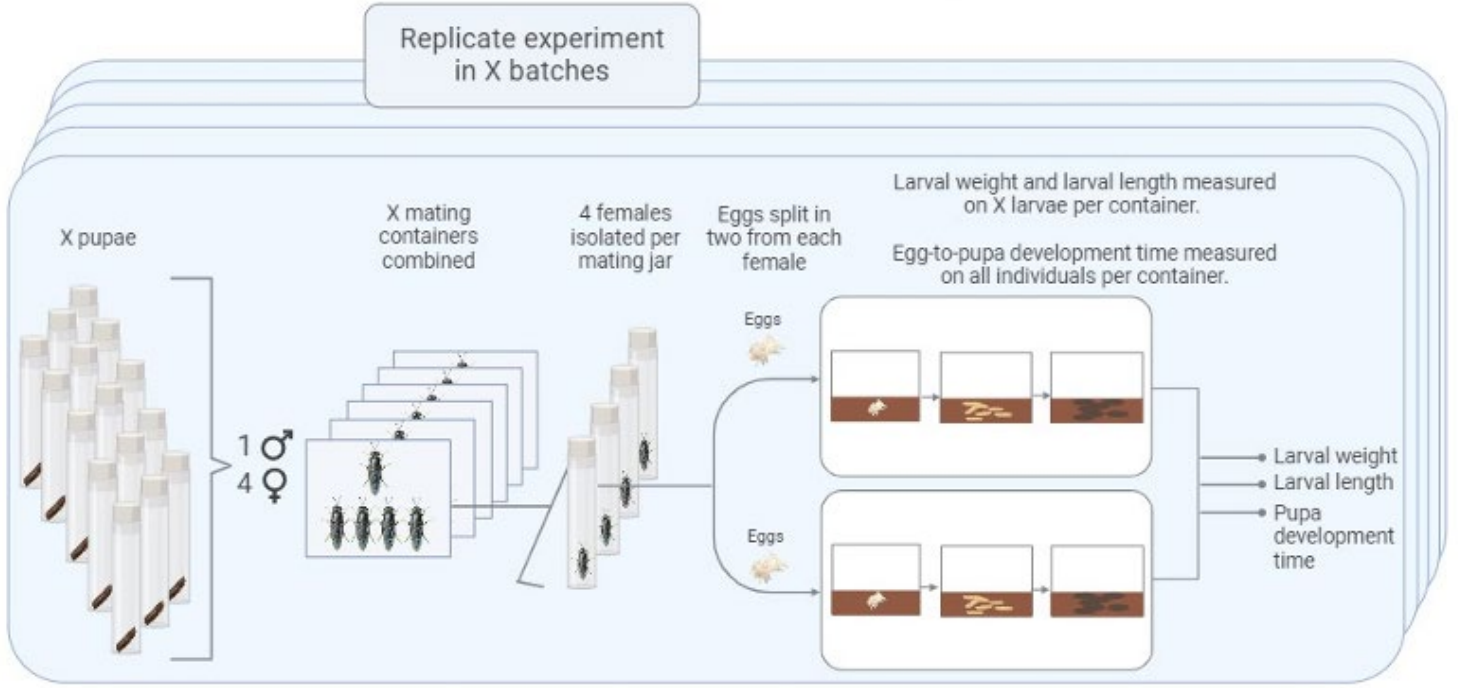


WP4: Genetics Parameters

Genetic parameter estimation

Sib family formation

Protocols for phenotyping



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WP5: Design and optimization of breeding programs

- Founder-population sampled across diverse AEZs, from wild and captive stocks
- Establishment of BSF founder-population
- Deterministic and stochastic modelling
- Implementation of pilot breeding programs

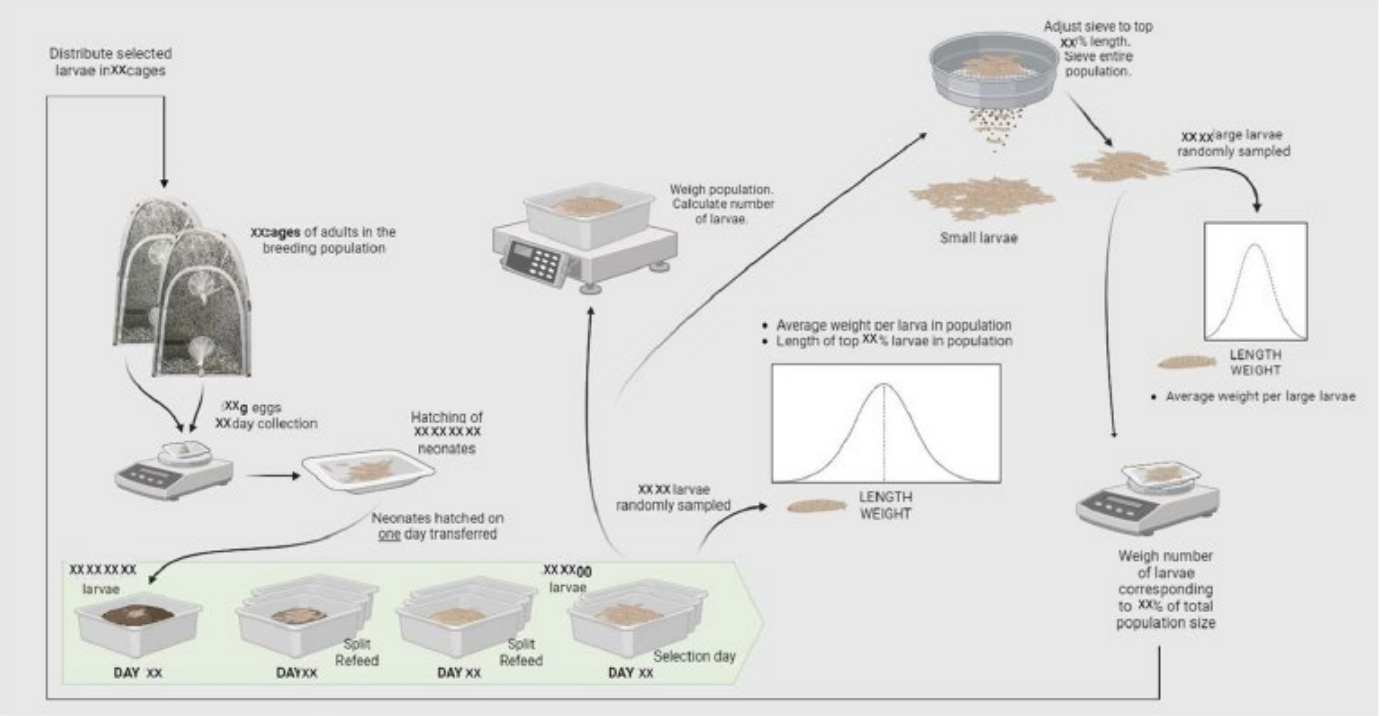
WP5: Design and optimization of breeding programs

Implementation of pilot breeding programs

Joint design of protocols wit commercial partners to start mass selection

Protocol for phenotypic/mass selection of BSFL

(Generic version for modification by FlyGene's private sector partners)



CAPACITY BUILDING

Sarah Nawoya
computer vision for large scale identification and phenotyping

Peter Kimani Muchina
Genetic diversity and population structure

Frank Ssemakula
Non-destructive, high-throughput technologies to assess the nutritional value

Maweu Annastacia Nduku
Traitpreferences

Chesang Sumukwo
Genetic parameters

Hulunim Gatew Tariku
Economic Values and optimizing of breeding scheme

CAPACITY BUILDING

Insect research facilities

Stakeholders engagement

National stakeholder forums

Large-scale household surveys

Insects for the Green Economy Conference

28-29 February 2024

Summary of participants

- **Total abstracts = 60**
- **Oral presentations = 26**
- **Posters = 16**
- **Number of participants = 152**
- **Exhibitions = 8**
- **Participating organizations = 55**

https://doi.org/10.5281/zenodo.12605312

Progress so far …

- Trait preferences
- Phenotyping techniques
- Population genomics
- Challenge in establishing families
- Phenotypic selection set-up established in a commercial farm
- Started simulating scenarios for breeding plans

Acknowledgements

FLYgene

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Thank you for your attentions

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