

# Breeding strategy for bean stem maggot resistance in Zimbabwe

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# Introduction

- Bean stem maggots (BSM) (*Ophiomyia* spp) belongs to Dipteran family, pest of economic importance
- Studies conducted were focusing on-identifying resistant genotypes, understanding of inheritance and mechanism of resistance & best agronomic control practices
- In comparison with breeding for disease resistance, very few released varieties on market
- In addition, several protocols have been used in evaluation for pest resistance, however, there are challenges; rearing of adequate insect population (no standard protocol), screening under natural infestation (depend on environment beyond researchers control).
- GXE is a serious challenge in breeding therefore evaluation & selection should be done under target production environment.
- Seasonal variations & environment----- the use of molecular approaches can reduce false positives when screening for BSM resistance and are also useful in shortening the breeding cycle.

# Research objectives

## **Overall objective**

- To contribute to the improvement of common bean production in Zimbabwe and beyond through developing market-preferred bean stem maggot resistant varieties.

## **Specific objectives**

- Develop and validate effectiveness of existing bean stem maggot resistance screening protocols
- Identify genomic regions associated with bean stem maggot resistance using GWAS
- Identify Quantitative Trait Loci conferring resistance to bean stem maggot resistance

# Materials and methods

Table 1: Research sites for natural infestation

Testing site	Agro Ecological Region	Soil type	Rainfall (mm)	Geographic position	
				Latitude	Longitude
Nyanga	1	Loam	1000	17°53'E	32°52'S
Save valley	5	Alluvial	400	31°56'E	21°01'S

NB-Nyanga and Save valley Experiment are natural hot spot sites for insect pests

**Research objective # 1-** Develop and validate effectiveness of existing bean stem maggot resistance screening protocols

Validating field screening protocol at 2 sites in Zimbabwe under natural infestation



Two hot spot areas identified (Nyanga & Save Expt)  
Delayed planting at both locations (March & Mid April)



300 ADP lines will be used  
10x30 alpha lattice design  
Plot size-6x 1.5mx0.5m and 10cm in row spacing

**1. No choice experiment**  
Seven net cages per replication, 3 reps, 4 plastic pots in each cage, CRD design, 20 adult flies in each cage, 3 successive screenings

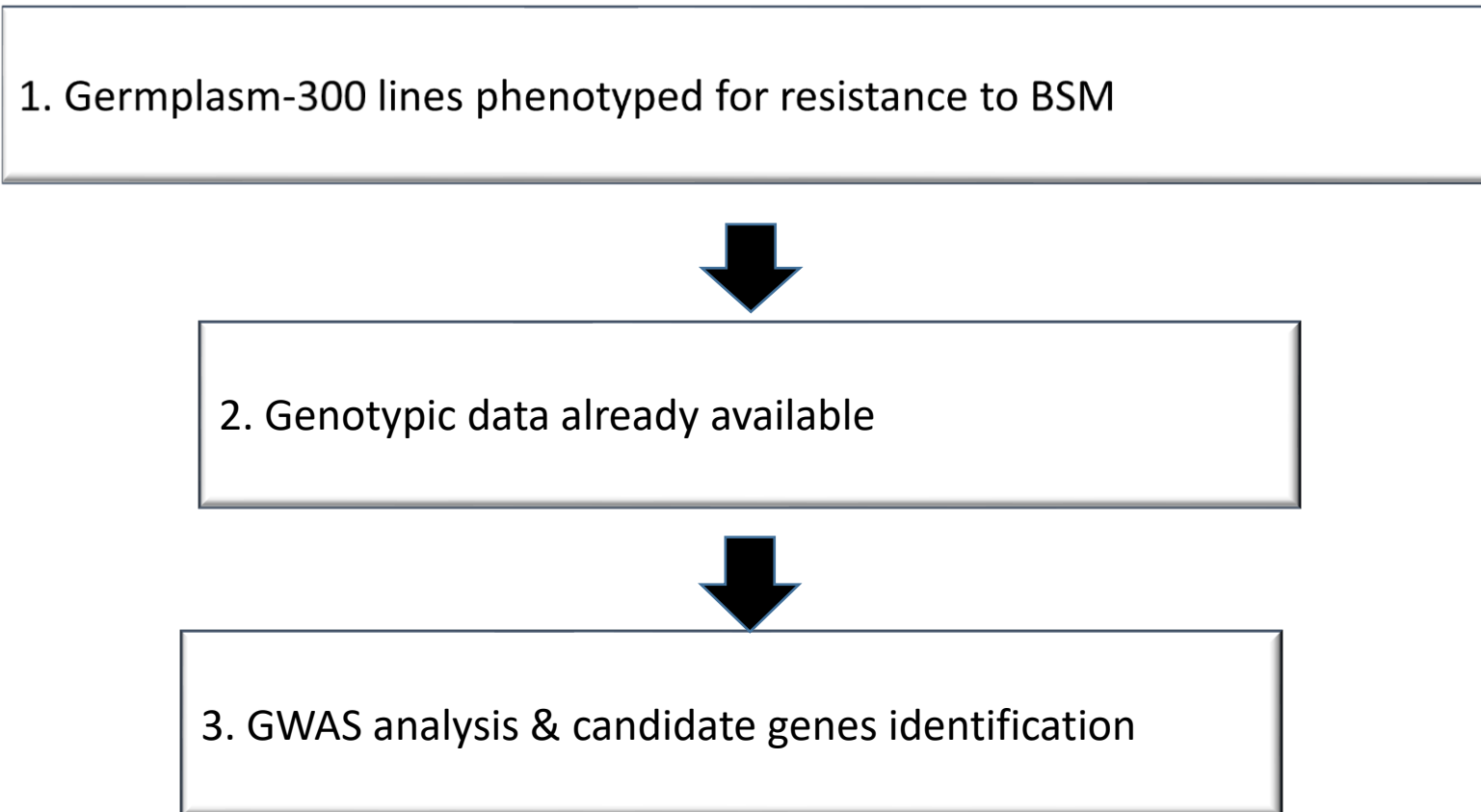


**2. Free choice experiment**  
Three net cages, metal frames covered with fine insect mesh, single row plots 1.5m X0.50mX0.10m, 50 freshly emerged adult flies in each cage, 3 successive screenings



**3. 20 genotypes planted in polythene bags, replicated 3 times in alpha lattice design**  
Collect BSM pupae from fields and infest bean plant stems, start life cycle.

## Research objective # 2 Identify genomic regions associated with bean stem maggot resistance using GWAS



# Materials and Methods

**Research objective #3** Identify Quantitative Trait Loci (QTL) conferring resistance to bean stem maggot.


**Germplasm**-Two resistant and two susceptible genotypes



## **Mapping population development and advancement**

Select susceptible parent #1 X resistant parent #1 and susceptible parent #2 X resistant parent #2.

To generate 300 crosses, advanced using SSD selection method to generate 600 F4:5 RILS, evaluated for bean stem maggot resistance using the developed screening protocol



**QTL mapping study**- F4.5 population will be genotyped using Genotyping by Sequencing at SEQART Africa. The QTL analysis (*Inclusive composite interval mapping (ICIM-ADD) method in IciMapping V.4.2*) will be used to identify genomic regions and markers for bean stem maggot resistance

# Data collection

**Resistance on bean fly will be assessed based on:**

- No. of feeding punctures
- Stem damage
- Pupae count in each plot
- Plant mortality rate

## **Agronomic Traits**

<b>Agronomic traits</b>	<b>Measurement/scoring scale</b>
Grain yield	Kg per plot
Days to 50% flowering	No. of days from planting to when 50% of the plot plants have at least one or more flowers
Days to 90% physiological maturity	When 90% of pods in a plot have dried
No. of pods per plant	Average no. of pods from 5 randomly selected plants
No. of seed per plant	Average no. of seeds from 5 randomly selected plants
No. of seed per pod	Average no. of seeds per pods from 5 randomly selected plants



## Expected outcomes of the study

- PhD thesis
- 5 publications
- New screening protocol for BSM resistance to be developed
- New sources of resistance to BSM identified and confirmed
- Genomic regions associated with BSM resistance will be identified
- BSM resistance population
- BSM breeding strategy developed



# Acknowledgements



Alliance



Thank you

