

**Genetic dissection of resistance to anthracnose in
Yellow Bean Collection of common bean
(*Phaseolus vulgaris* L.)**

By

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Objectives

1. Evaluate the Yellow Bean Collection for resistance to eight races of *C. lindemuthianum*
2. Conduct genome-wide association analysis to identify genomic regions and candidate genes associated with resistance to eight races of *C. lindemuthianum*

Results

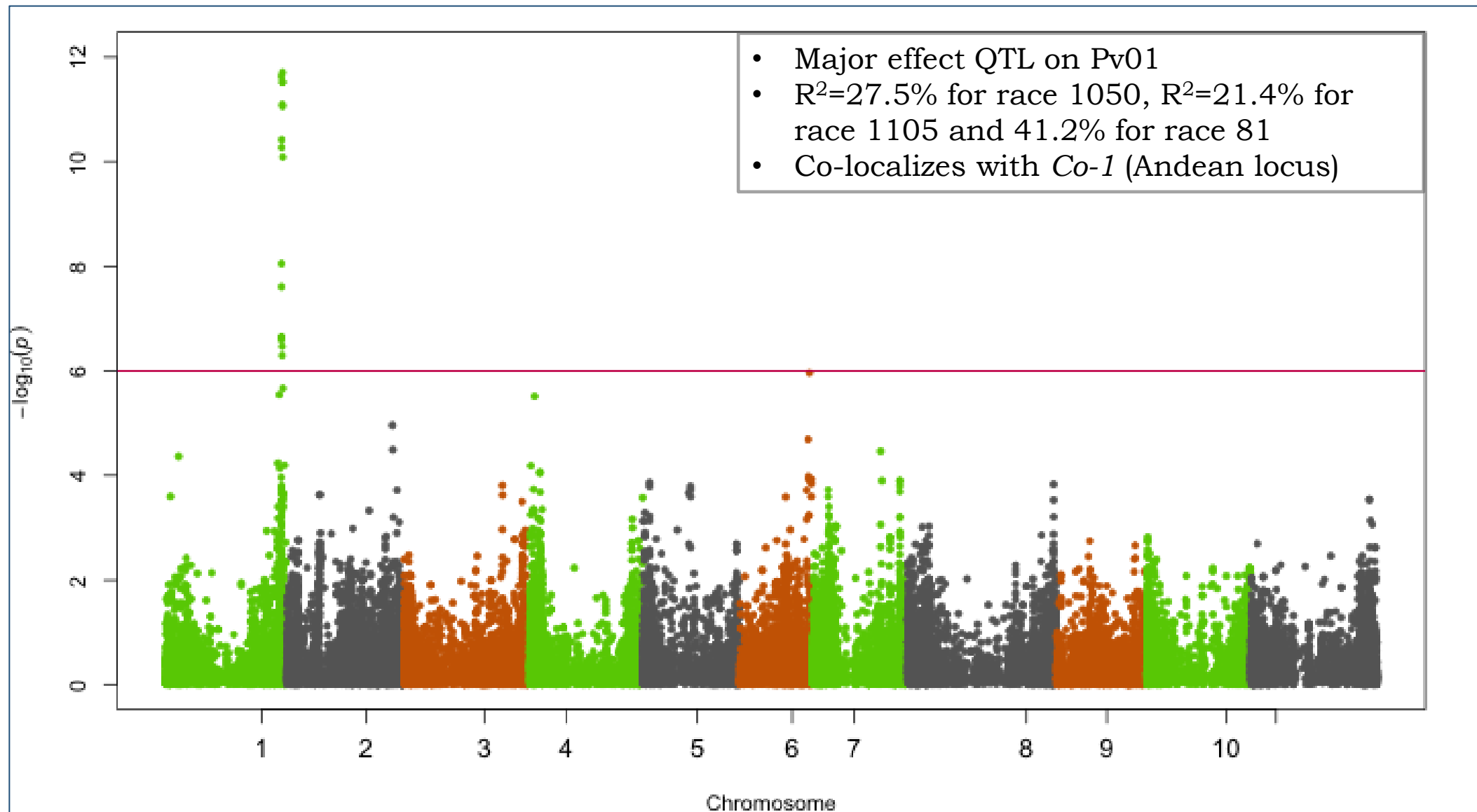
- Five genotypes out of 273 were found to have high resistance to the eight races
- YBC 278 was the only genotype that was resistant to all eight races

Results

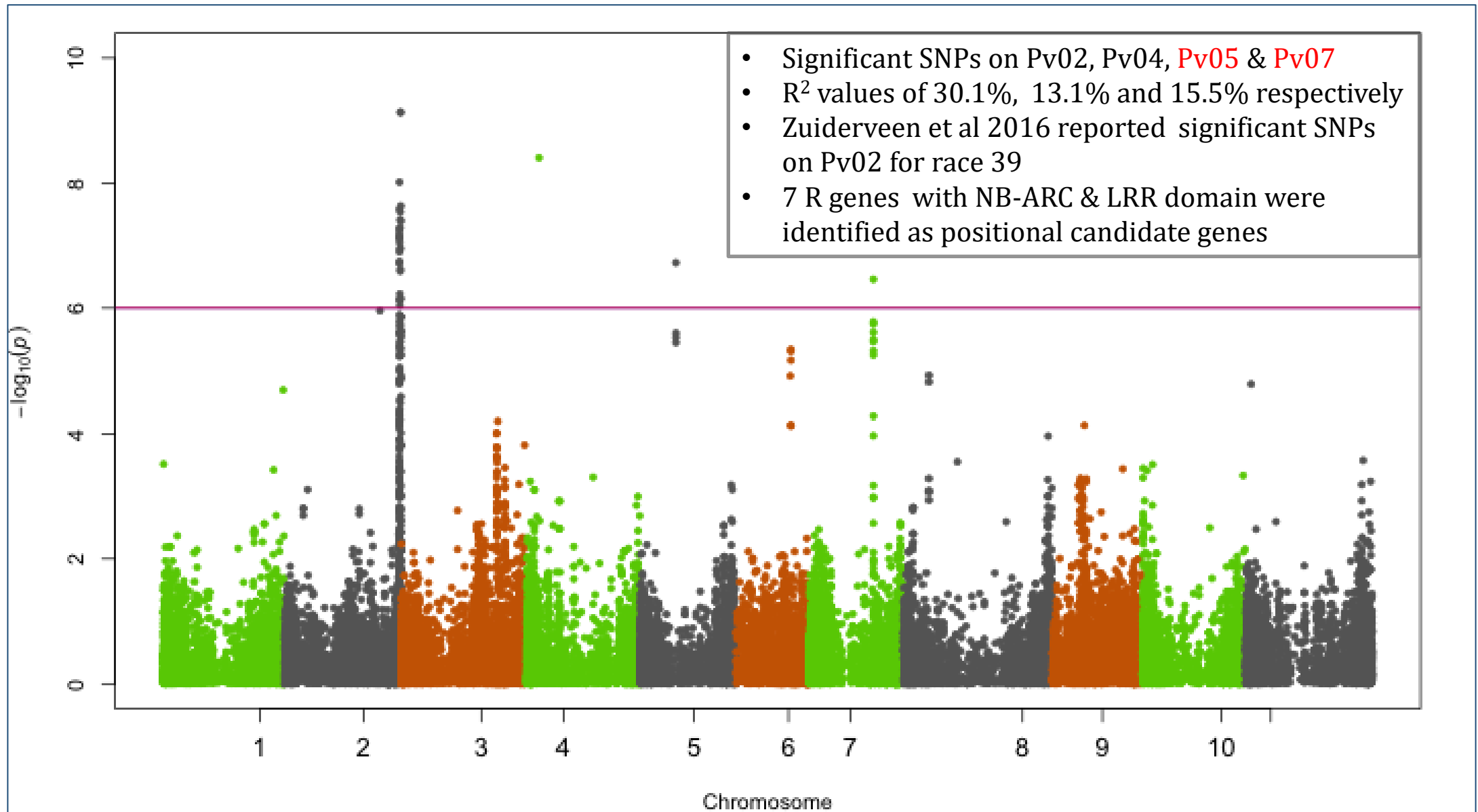
Mean anthracnose severity scores for five YBC genotypes identified as being highly resistant against eight races of *C. lindemuthianum* after inoculation in the greenhouse at University of Zambia

YBC ID	ID	Country	Seed color	Genepool	Mean anthracnose scores								
					Race 5	Race 19	Race 39	Race 51	Race 81	Race 183	Race 1050	Race 1105	
YBC278	SMC28	Uganda	Amarillo	Middle- American	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
YBC130	P1527538	Burundi	Green yellow	Andean	1.0	1.0	-	1.2	1.0	1.0	1.0	1.0	1.0
YBC173	G22501	Burundi	Green yellow	Andean	1.0	1.0	9.0	1.0	1.0	1.0	1.3	1.0	1.0
YBC267	DAB933	Uganda	Amarillo	Andean	3.3	1.0	1.0	1.0	1.3	3.5	-	1.0	1.0
YBC192	Roba-1	Uganda	Amarillo	Middle- American	1.0	1.3	-	1.0	6.8	1.0	1.7	1.0	1.0

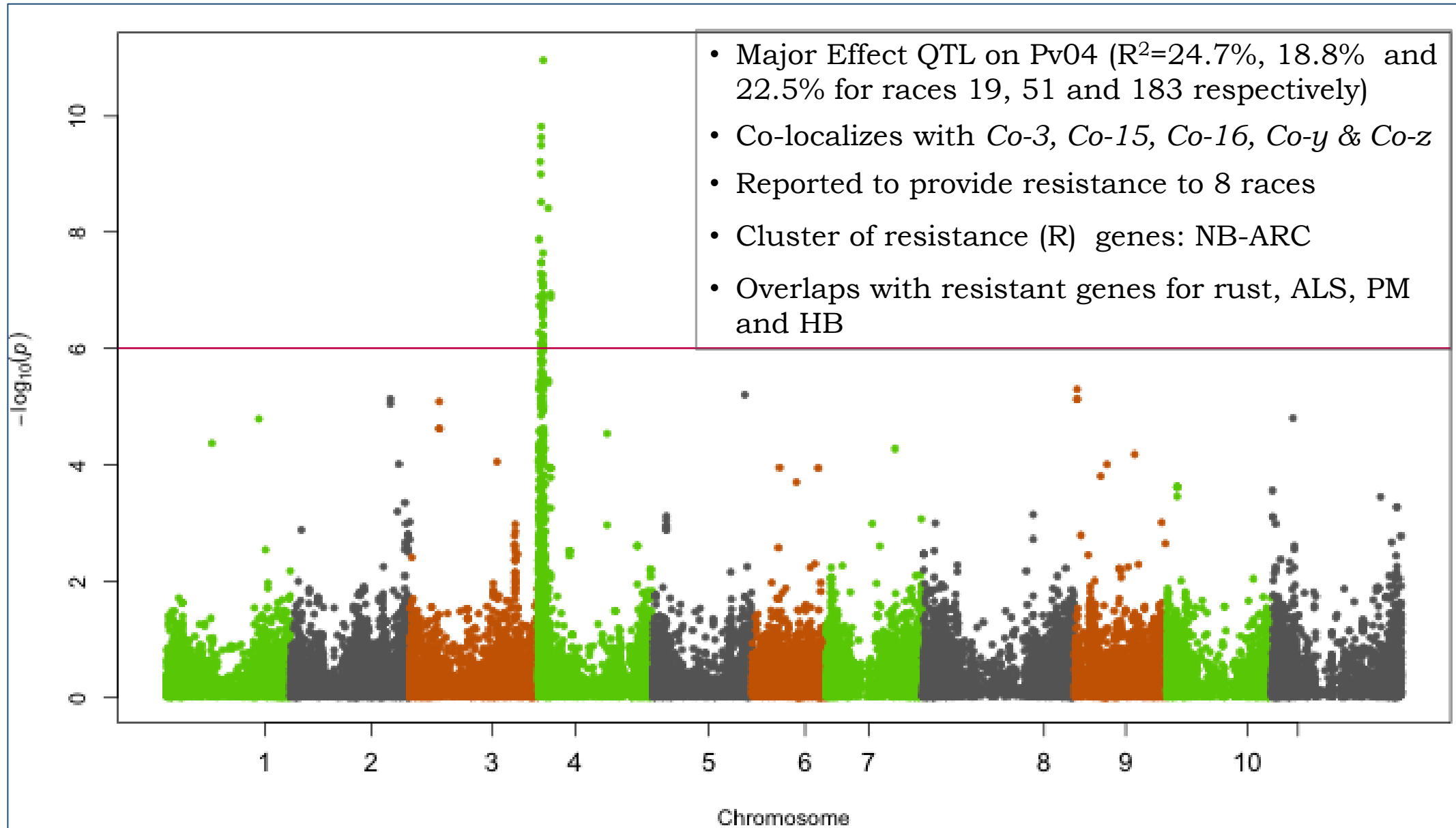
GWAS for Resistance to Races 81, 1050 & Race 1105 in the YBC



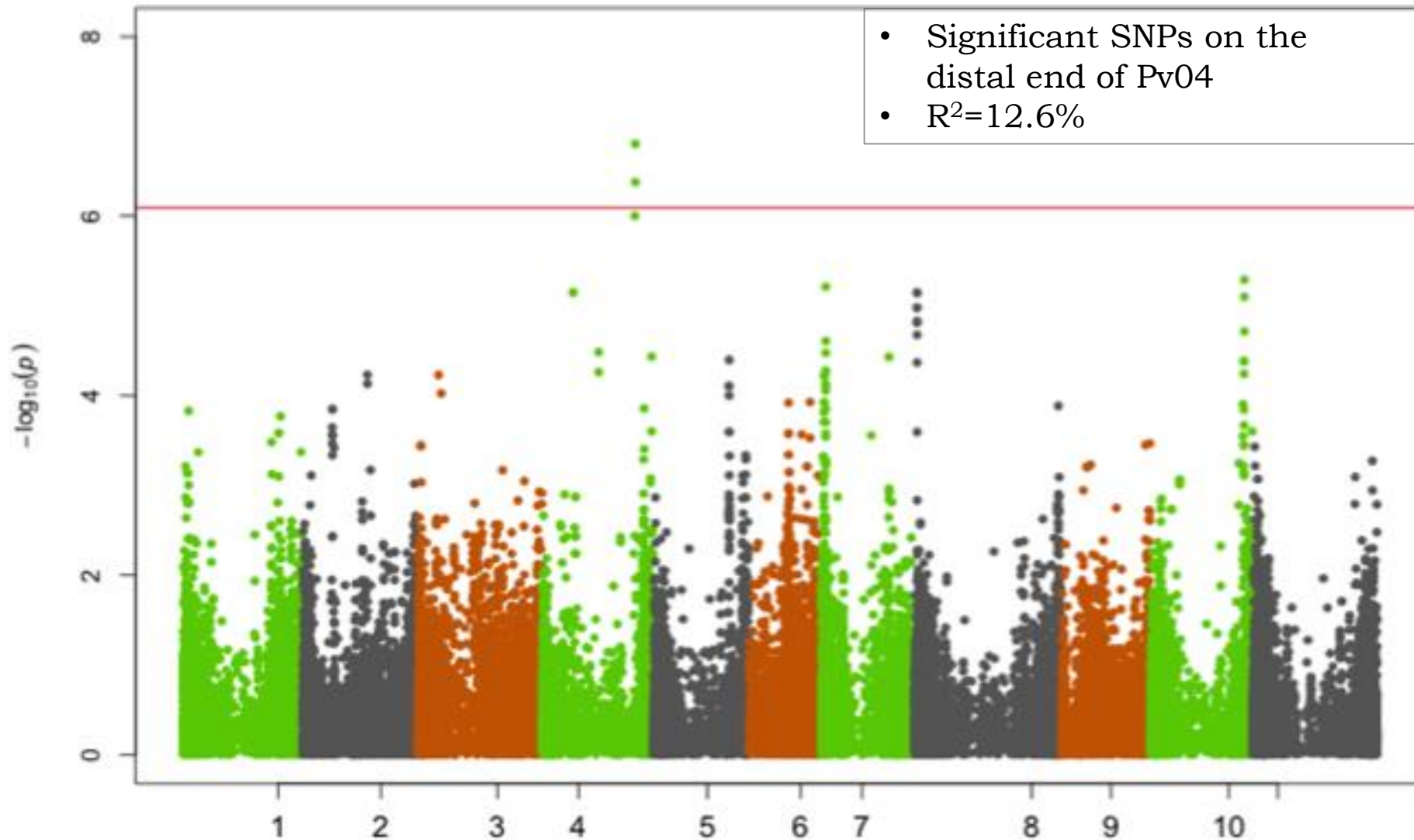
GWAS for Resistance to Race 39 in the YBC



GWAS for Resistance to Races 19, 51 and 183 in the YBC



GWAS for Resistance to Race 5 in the YBC



**GENETIC IMPROVEMENT OF COWPEA
PLANT ARCHITECTURE FOR SUPERIOR
AGRONOMIC PERFORMANCE**

BY

KUWABO KUWABO

(PhD proposed Study)

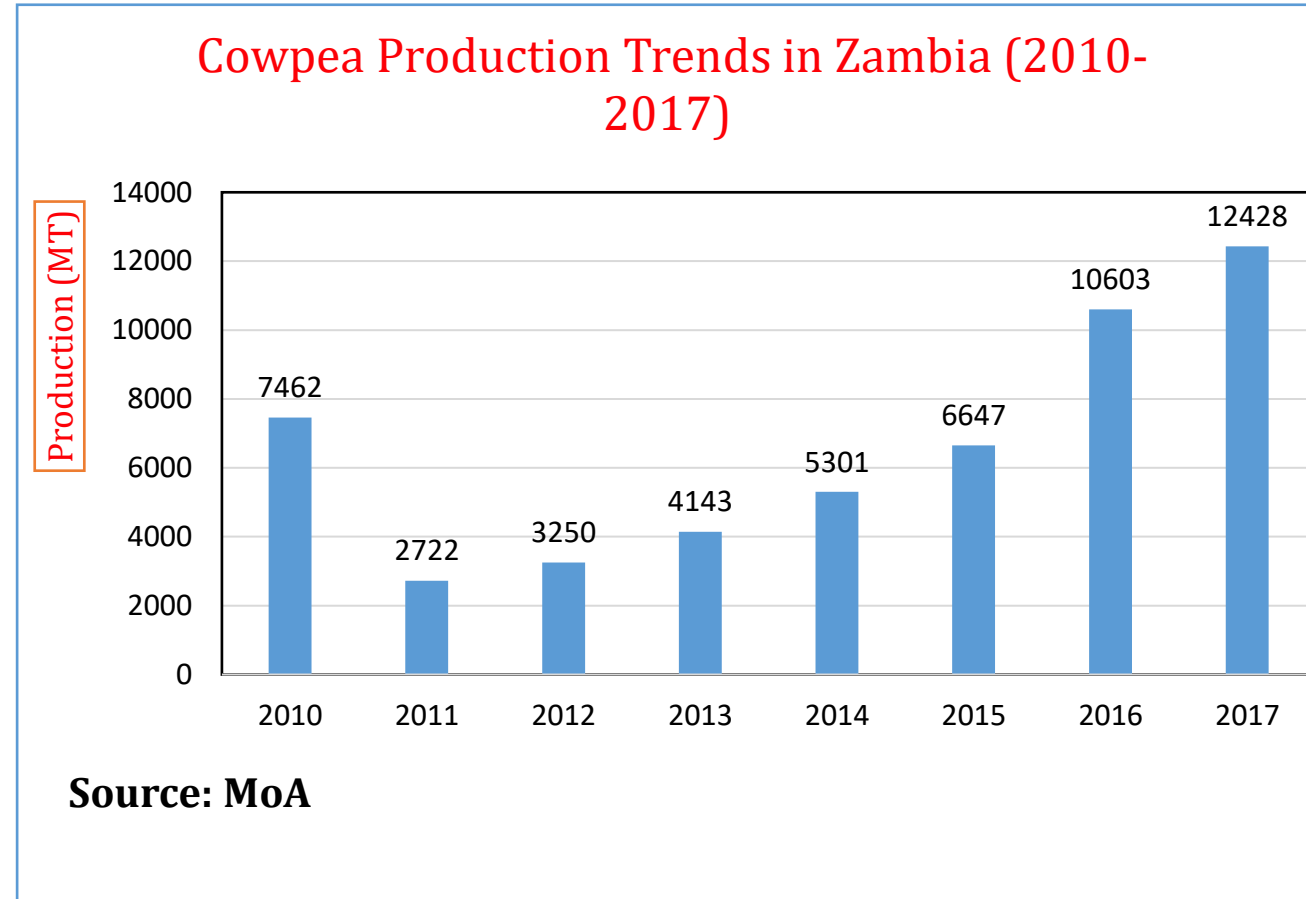
Cowpea Production in Zambia

- Cowpea is an important Crop in Zambia
 - Especially in the Southern province of Zambia
 - Suited for this region because of the low rainfall this region receives (<800 mm/year)
 - Used for grain and fodder
 - Also grown for soil fertility
- One of the legumes the government is trying to promote in its crop diversification policy as a way of mitigating climate change effects especially drought
- Different seed types: color and size
 - Large size preferred
 - Few improved varieties on the market
- About 13 000 ha under cultivation



Cowpea Production Trends/Constraints in Zambia

- Grain yield of cowpea relatively low
- About 0.5 – 1.0 ton/ha
- Use of landraces with low yield potential
- Biotic and abiotic stresses
- Diseases: Ascochyta
- Pests: Aphids and Pod borer (*Maruca vitrata*)
- Post Harvest pests: Cowpea weevil (*Callosobruchus maculatus*)



- Plant architecture of cowpea plays an important role in its adaptation to pest resistance and easy harvesting.
- Creating genetic variation and understanding the genetic basis of that variation could support genetic enhancement of seed yield in cowpea.
- Mutagenesis is one way in which this variation can be created



Varieties Targeted for Mutational Breeding



Namuseba Preferred by consumers for:

1. Seed color
2. Seed size
3. Taste



- Gamma Irradiated (150 grays)

Mutant collection and Mutant Diversity Panel (MDP)

- A large diverse set of cowpea mutant germplasm developed
- About 16,000 mutants
- Subset with 750 M5 mutants known as Mutant Diversity Panel (MDP)
- Constituted to capture diversity of the 16000 mutants based on:
 - Phenology
 - Yield and yield components
 - Plant architecture
 - Seed color



Plant architectural traits

Peduncle length

- Important for adaptation
- Enables easy harvest
- Important for pest infestation avoidance
- Some mutants have been identified as having long peduncles



Plant architectural traits

Pod angle (Pod orientation)

- 3 different categories
- Erect ($> 90^{\circ}$)
- Semi erect (90°)
- Pedant ($< 30^{\circ}$)
- Erect pod orientation potentially plays a role in pest resistance
- Mutants with unique pod orientation have been identified

Erect



Semi - erect



Pedant



Number of pods per peduncle

- Yield component and affects productivity
- Variation observed in the mutant collection
- Mutants with higher number of pods per peduncle have also been identified



Overall objective

- The objective of the proposed project is to understand the genetic control of plant architecture traits of cowpea.

Specific objectives

- Characterize the Mutant Diversity Panel for plant architecture traits including peduncle length, pod orientation (angle) and number of pods per peduncle.
- Pyramid genes for long peduncle, erect pod orientation and higher pod number per peduncle in the same genetic background.
- Map quantitative trait loci for peduncle length, pod orientation and pod number per peduncle.

Materials and methods

Objective 1 : Characterize the Mutant Diversity Panel for plant architecture traits.

- Field trials to be conducted in 2023 growing season
 - Mochipapa
 - Kabwe research stations
- Characterize the MDP for plant architecture traits including
 - Peduncle length
 - Pod orientation and
 - Number of pods per peduncle

Materials and methods

Objectives 2 & 3: Pyramid genes and map quantitative trait loci for long peduncle, erect pod orientation and number pods per peduncle.

- Multi location trials
 - Kabwe
 - Mochipapa
- Evaluate MDP for peduncle length, pod orientation and number of pods per peduncle



Pyramid genes and QTL mapping for peduncle length, pod orientation and number pods per peduncle.

PL - peduncle length
 PO - pod orientation
 NPP - number pf pods per peduncle

Mutilizi mutant population

Namuseba mutant population

Evaluate for architectural traits

Evaluate for architectural traits

Mutant with combination of PL, PO, NPP identified

Namuseba

Mutilizi

Mutant with combination of PL, PO, NPP identified

X
↓
F1

X
↓
F1

RIL population segregating for PL, PO, NPP

RIL population segregating for PL, PO, NPP

Conduct QTL analyses for PL, PO, NPP

Conduct QTL analyses for PL, PO, NPP

ACKNOWLEDGMENTS



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Trust Supporting research and education
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