



Enhancing Potato Resilience: challenges and advances in breeding for bacterial wilt resistance in East Africa

Webinar

Use of potato wild relatives: Major findings and
challenges

Thiago Mendes et al.

11/12/2023

The BOLD Potato Project



<https://bold.croptrust.org/crops/potato/#c7801>



The BOLD Potato Project

Why potato?

Project partners

Activities

Potato stories

The BOLD Potato Project

The BOLD potato project aims to increase the potato diversity available to potato breeding programs and farmers by integrating lines derived from crop wild relatives (CWR) into breeding pipelines and developing new elite varieties with introgressions from CWR.



The BOLD Potato Project

POTATO WILD RELATIVES

Bacteria wilt

- *S. commersonii*,
phureja, *tuberosum*



Drought

- *S. boliviense*
- *S. bukasovii*
- *S. infudibuliforme*
- *S. lignicaule*
- *S. raphanifolium*
- *S. tacnaense*
- *S. tarapatatum*

Late blight

- *S. microdontum*
- *S. tarijense*
- *S. megistacrolobum*
- *S. chiquidenum*
- *S. pausisectum*
- *S. cajamarquense*
- *S. sogarandinum*

Potato in sub-Saharan Africa (SSA)

- Food security and cash crop for ~ 5 million potato farmers
- Short cropping cycle of 3-4 months; 1-3 growing seasons/year
- An important crop for the “hunger months”
- Area has increased 2-6x in past 25 years, ~1.6 million ha
- Average yield 6-10 t/ha vs potential yield 40 t/ha



Bacterial Wilt: re-emerging issue

Increasing prevalence and incidence from 2017-2018 survey

Country	BW prevalence
Ethiopia	60% (158 out of 263 farms)
Kenya	72% (128 out of 176 farms)
Rwanda	80% (84 out of 104 farms)
Uganda	75% (166 out of 288 farms)

Detected from altitude of 3,300 masl seed producing area

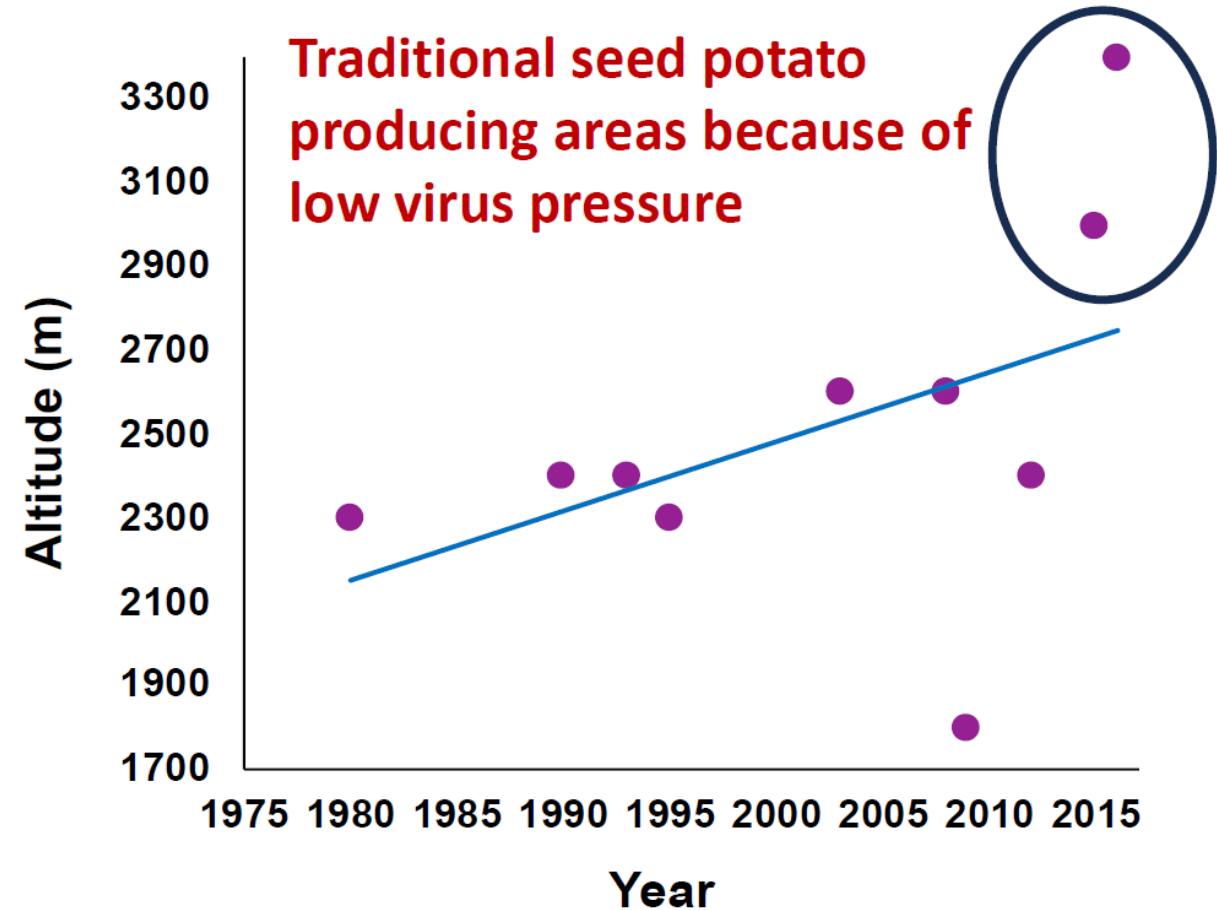
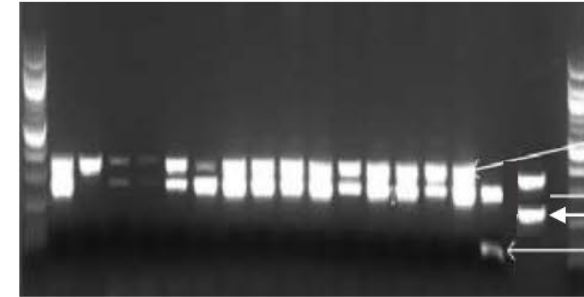
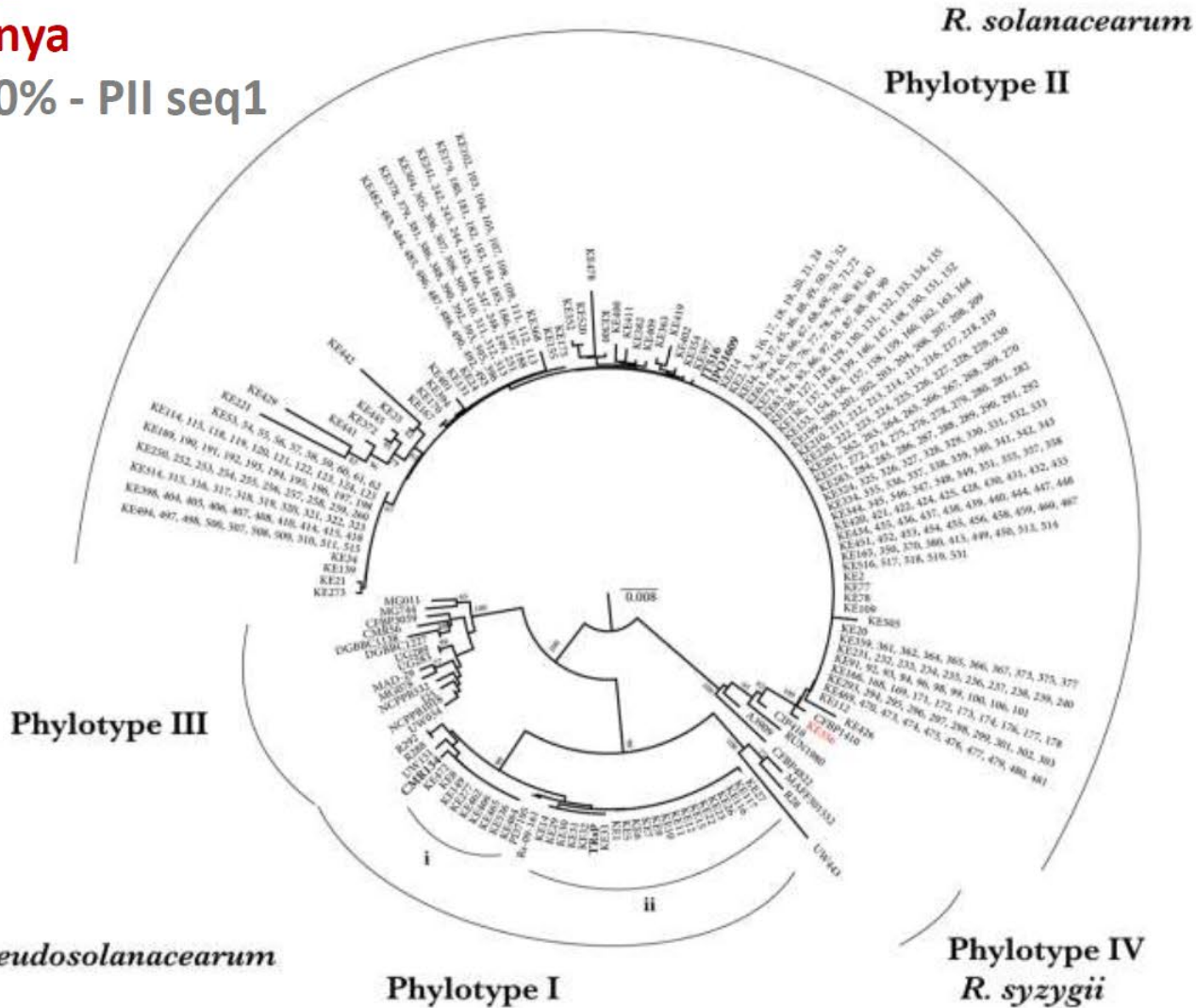


Figure 1. Bacterial wilt incidence at different altitude. Positive correlation between observed incidence of bacterial wilt at higher altitudes in Ethiopia over years.

RSSC diversity- Ethiopia, Kenya, Rwanda, Uganda

Kenya
>90% - PII seq1

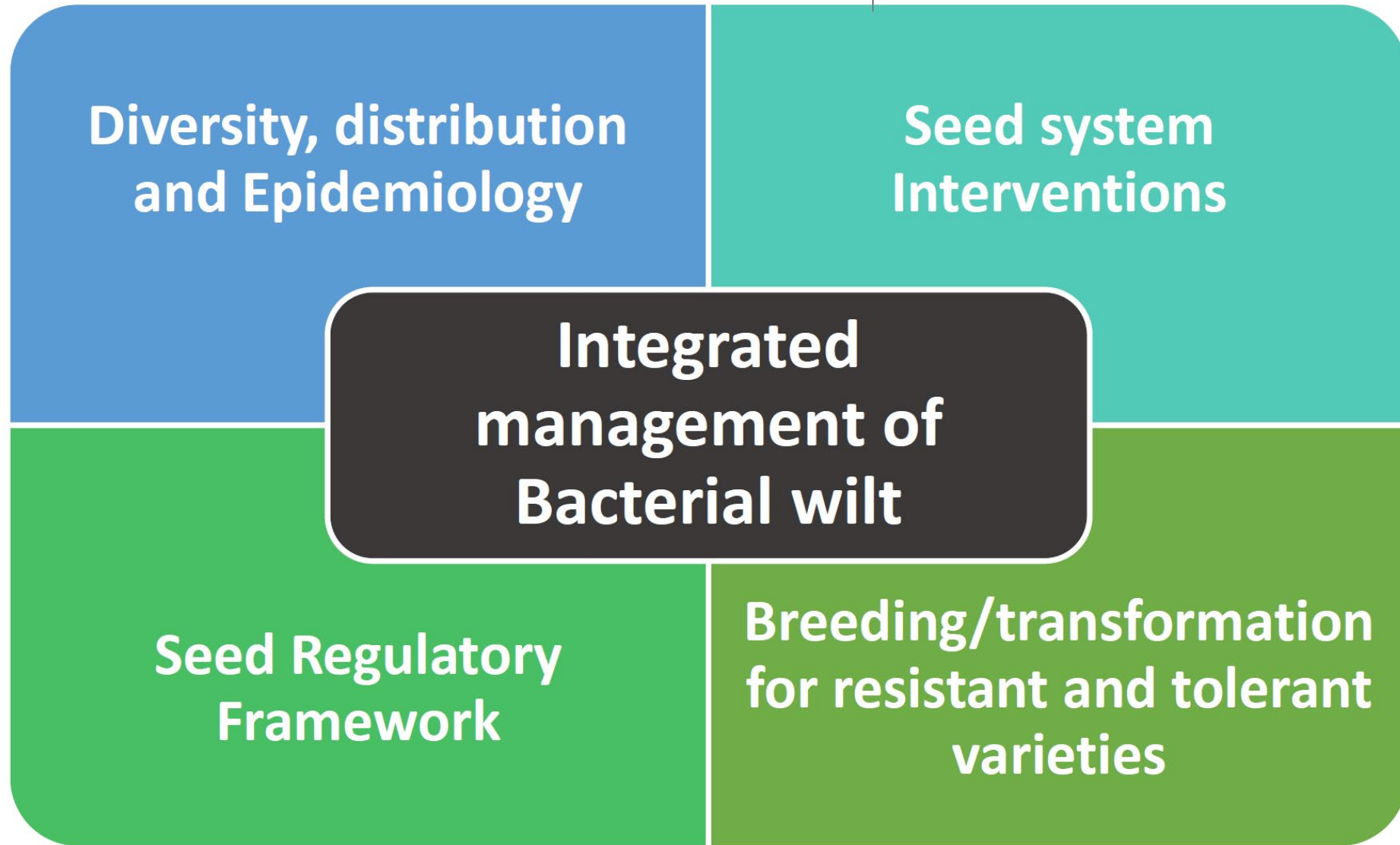


372 bp: Phylotype II
280 bp: RSSC
144 bp: Phylotype I
91 bp: Phylotype III

RSSC diversity from Eastern Africa**

East Africa	P I	P II	P III
Ethiopia		X	
Kenya	X	X	
Rwanda		X	X
Uganda	X	X	X

**Based on new classification- Phylotype I: Asia; Phylotype II: America; Phylotype III: Africa; Phylotype IV: Indonesia



BW breeding background

cmm (2n=2x; 1 EBN) × *phu* (2n=2x; 2 EBN)



F1

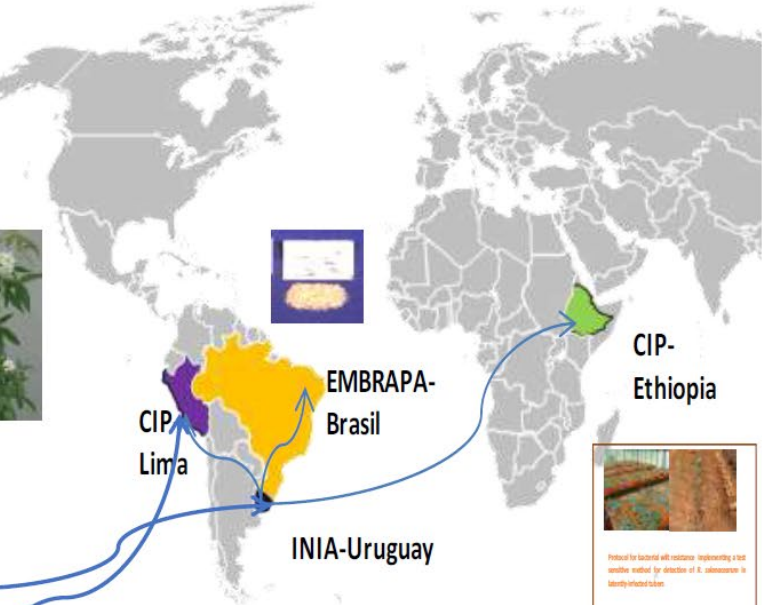
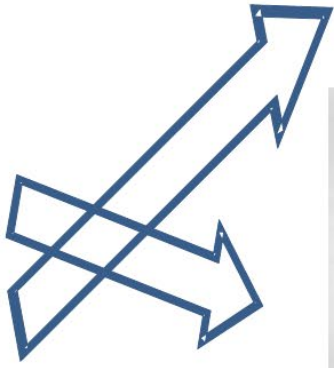
(*cmm* × *phu*) (2n=3x; 2 EBN) × *tbr* (2n=4x; 4 EBN)

BC1 × *tbr* (2n=5x; 4 EBN)

BC2



BC3



Race 3Bv2



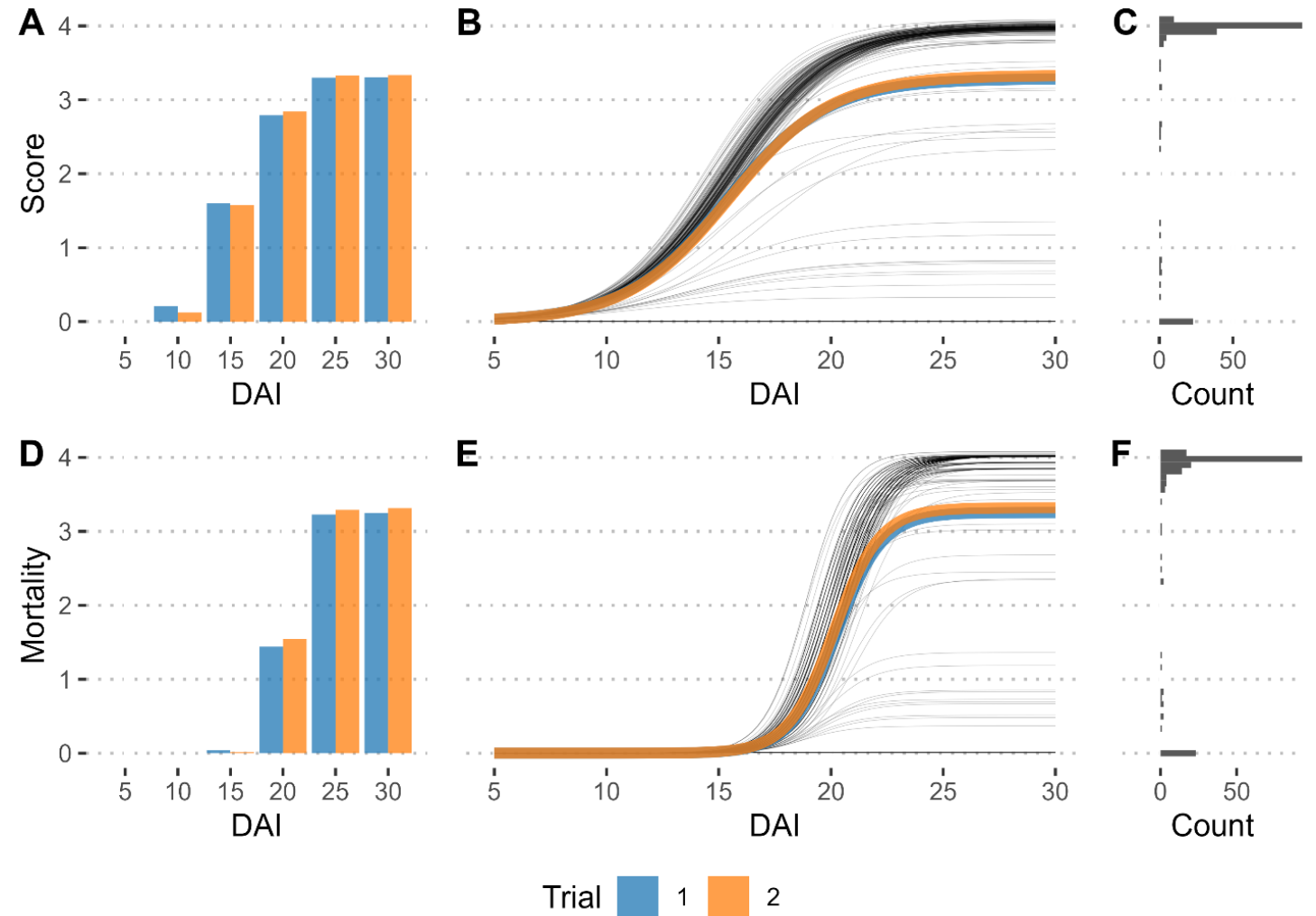
Race 1



Assessing the genetic diversity in BC3 pool

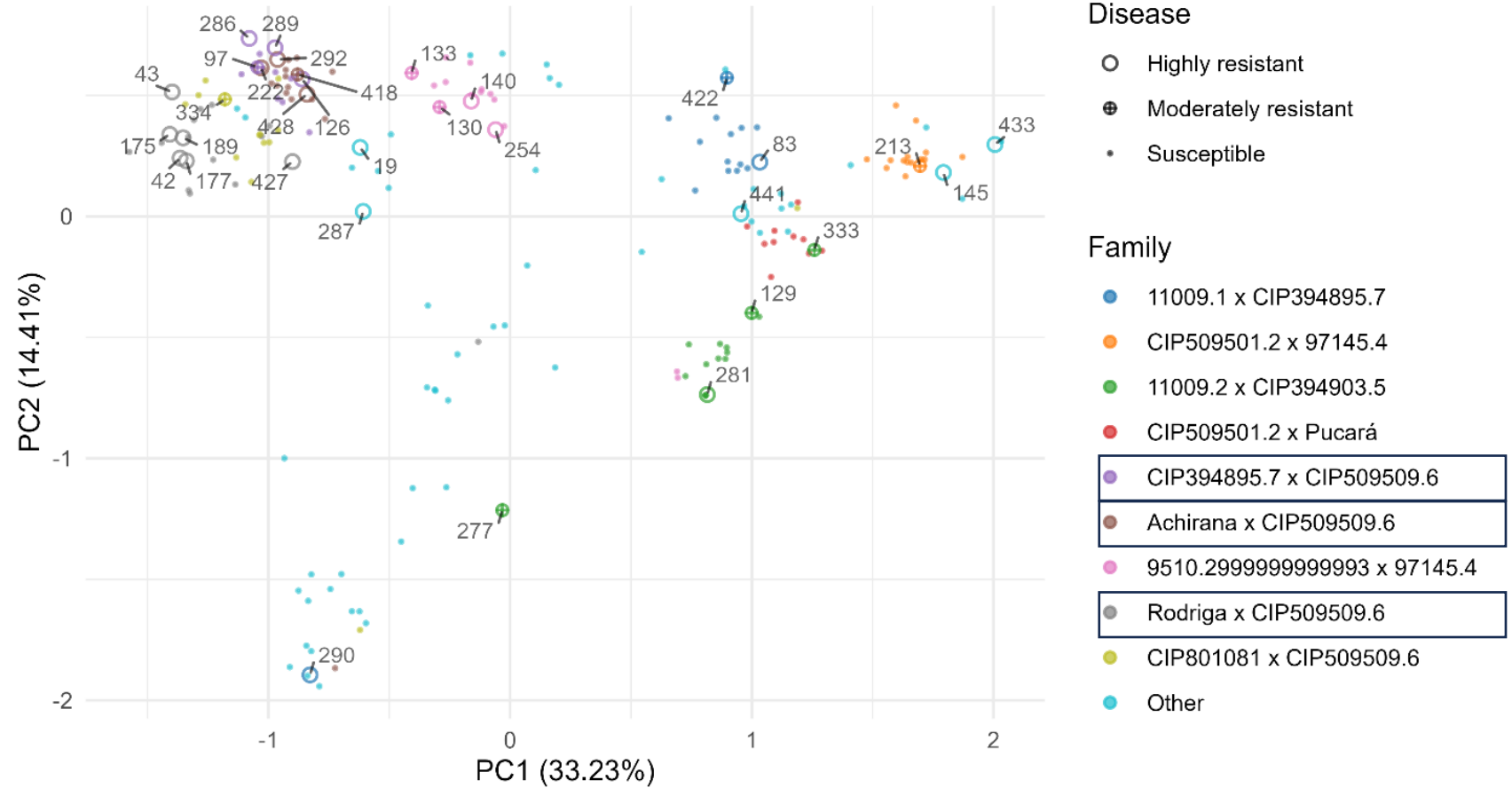
PHENOTYPING RESULTS

- There were no disease-related phenotypes observed 5 days post inoculation (DPI).
- 26 potato genotypes remained asymptomatic even after 30 DPI.



Assessing the genetic diversity in BC3 pool

GENETIC DIVERSITY



Lilian Okiro, PhD student.
Egerton University, Kenya

Participatory Selection

BC3 pool

Kenya 2021



On going bacterial wilt inoculation

Derived resistant clones from BC2 Parents vs Heat tolerant parents

Kenya Oct 2023



Remarks

- BW tolerance - Potential to significantly reduce crop losses
- Collaboration is key in addressing this complex challenge.
- Breeding for resistance is an ongoing process in Kenya.
- Need to increase efficiency -high-throughput screening approach - to evaluate many genotypes

Thanks!





CIP is a research-for-development organization with a focus on potato, sweetpotato and Andean roots and tubers. It delivers innovative science-based solutions to enhance access to affordable nutritious food, foster inclusive sustainable business and employment growth, and drive the climate resilience of root and tuber agri-food systems. Headquartered in Lima, Peru, CIP has a research presence in more than 20 countries in Africa, Asia and Latin America.

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