

CAPACITY BUILDING FOR COMMON BEAN IMPROVEMENT IN SUB- SAHARAN AFRICA

*MUKANKUSI CLARE
MUGISHA*



PAN-AFRICA BEAN RESEARCH ALLIANCE (PABRA) MEMBER COUNTRIES (28)



DONORS
CIDA, SDC,
USAID,
BMGF,
McKnight,
ASARECA,
KHT,
SADC-
FANR ,
AGRA,
NGO, GO

MY JOURNEY

Position	Organization	Major activities
BSc Agriculture	Makerere University Kampala, Uganda	Disease and insect resistance screening of dual purpose cowpea
MSc Agriculture (Crop Science: Plant Pathology)	MUK	Participatory research on the management of Rosette and Cercospora leaf spot of groundnut
Agricultural Officer- Kyanamira Kabale district	Uganda Government	Implementing crop extension programmes and providing training in all crop related activities
Research Assistant	CIAT	Field Research to enhance seed production capacity of small-scale farmers in East Africa
PhD Plant Breeding	ACCI -University of KwaZulu-Natal /CIAT	improving resistance to Fusarium root rot of common bean
Research Associate	CIAT	Support to plant breeding and pathology Pan-Africa Bean Research Alliance (PABRA) projects
Post-doctoral fellow/ PABRA Network breeder	CIAT - PABRA	Overall support to plant breeding-pathology programs within PABRA





Ultimate Outcome

Intermediate Outcomes

Immediate Outcome

Improved nutrition and health, gender equality, food security, incomes and natural resource base for sustainable livelihoods of resource poor women and men farmers

Increased and in gender equitable manner utilization of improved and marketable bean varieties , new crop

Increased trade in a gender equitable manner

Increased response to demands in the bean sector , and utilizing information and knowledge to influence bean policy in a gender equitable manner

1.1: Increased access by especially women farmers to improved dry bean varieties resistant to multiple environmental stresses

1.2: Increased access to cost effective and environmentally friendly integrated stress management options (e.g. for soil fertility and water, pest and diseases) by particularly women farmers

1.3: Increased access to micronutrient rich bean based products in the diets of vulnerable communities

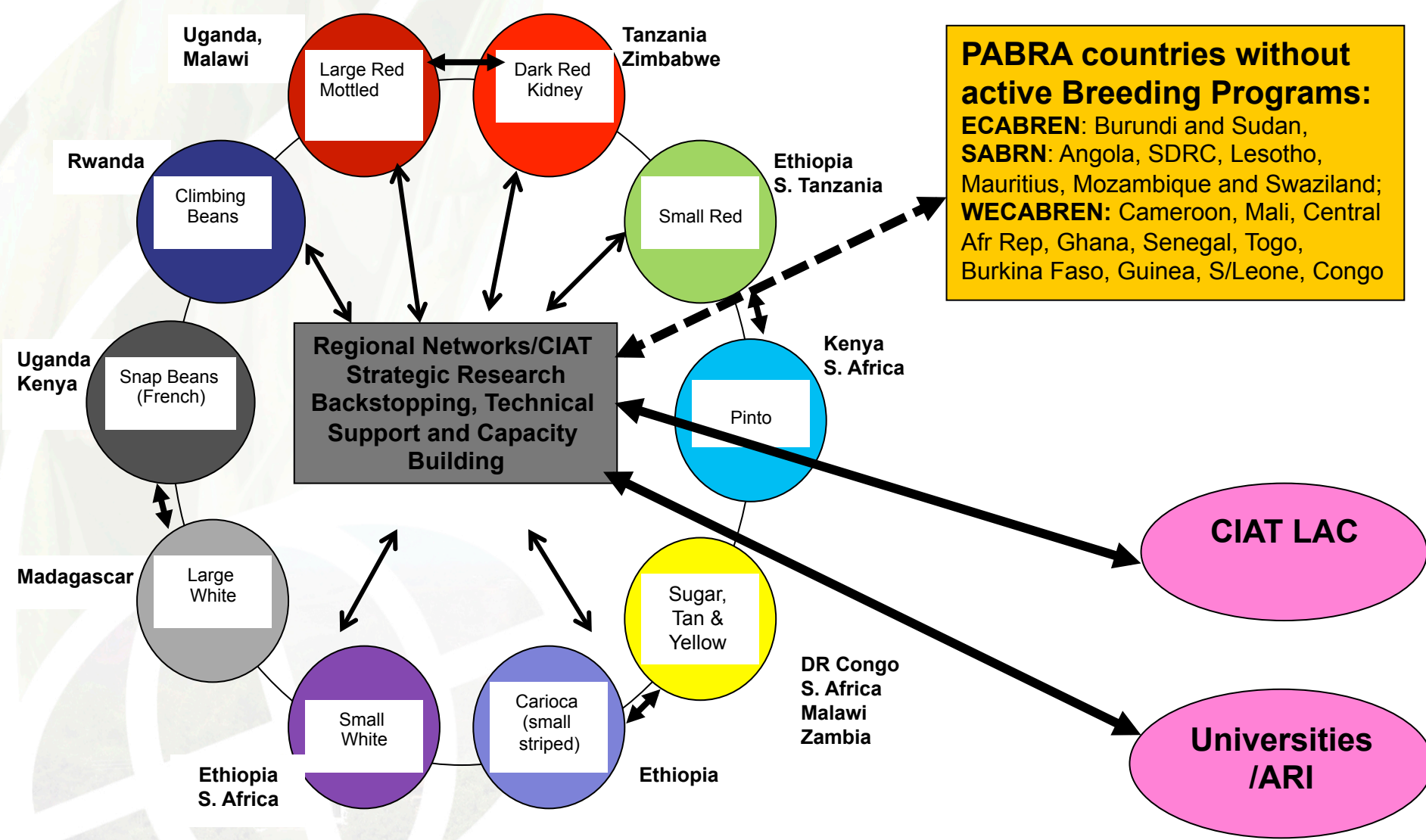
1.4: Increased access to high value bean products targeted to niche markets with a focus on women

1.5: Increased capacity of men and women to participate in technology development, delivery and decision making bodies equitably

2.1: Increased access to new and existing markets and opportunities for both men and women

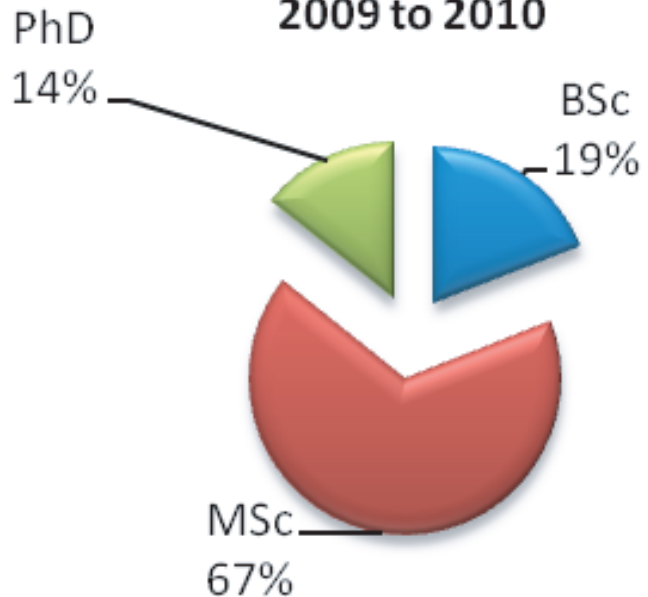
3.1: Increased access particularly for information and knowledge that shapes bean technology development, delivery and influence policy

Market-Class led breeding strategy and sharing breeding responsibilities

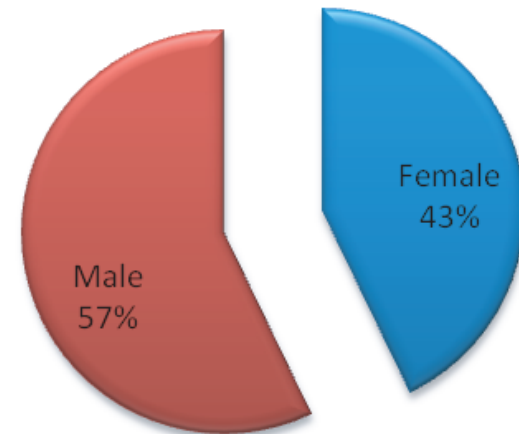


DEGREE TRAINING: DISTRIBUTION BY DEGREE TYPE AND GENDER 2009-2010 (N=43)

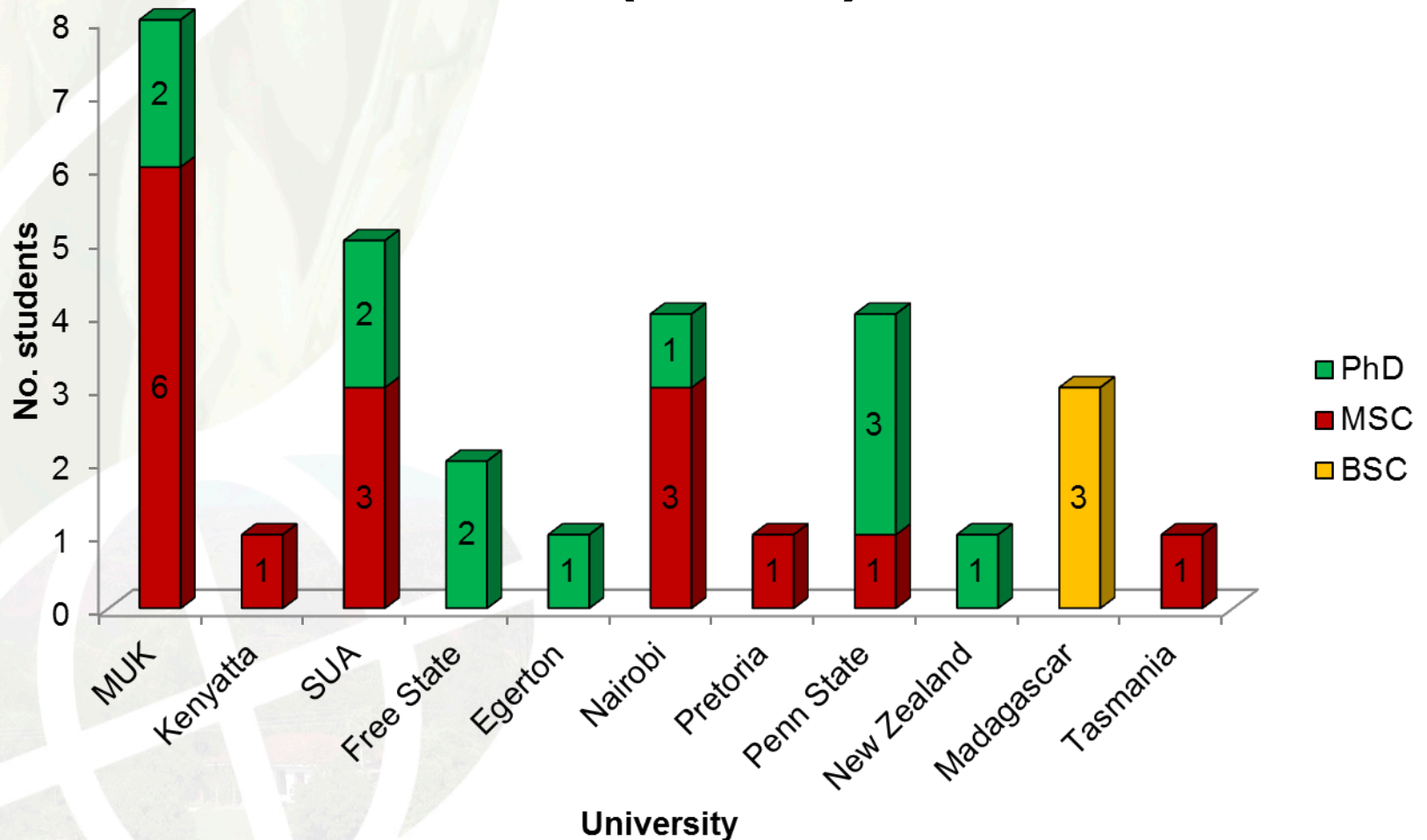
Distribution by degree type
2009 to 2010



Distribution by Gender



CURRENT DEGREE TRAINING (N=37)



CIAT-RUFORUM

- MSc degree in Plant Breeding & Seed Systems
- Research designed to fit within the PABRA framework

Immediate Outcome	Output	Research Area
1.1: Increased access by especially women farmers to improved dry bean varieties resistant to multiple environmental stresses	1.1.1: Current and future risks to bean production and utilization associated with major environmental stresses and end user systems reviewed and analyzed	Pathology/ entomology, physiology etc.
	1.1.2: Genetic, physiological, pathogenic and pest mechanisms conferring resistance to different environmental stresses studied, validated and documented	Breeding
	1.1.3: At least 130 new multiple stress resistant bean germplasm identified, widely tested and selected for release	Breeding
1.3: Increased access to micronutrient rich bean based products in the diets of vulnerable communities	1.3.1: Bean varieties with enhanced micronutrient concentration and superior agronomic traits accepted/released	Breeding
1.4 Increased access to high value bean products targeted to niche markets with a focus on women	1.4.1: Competitive and market demanded bean products (varieties), including dry bean and niche market varieties (snap, canning and organically produced) accepted/released in collaboration with smallholder farmers	Breeding

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Genetic analysis of resistance to *Fusarium* root rot in common bean

Clare Mukankusi · John Derera · Rob Melis · Paul T. Gibson · Robin Buruchara

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Abstract *Fusarium* root rot (FRR) is a major disease of common bean worldwide. Knowledge of the inheritance of resistance to FRR would be important in devising strategies to breed resistant varieties. Therefore, a 12 × 12 full dialled mating scheme with reciprocal crosses was performed to generate 132 F₁ progenies, which were then advanced to the F₂. The progenies were evaluated for resistance to FRR under green house conditions in Uganda. General combin-

generation. These results indicate that resistance to FRR was governed by genes with additive effects in combination with genes with non-additive effects. Reciprocal differences were also significant ($P = 0.01$) at F₁ and F₂, primarily reflecting a large influence of maternal effects in both these generations. In fact, susceptible parents did not differ significantly ($P > 0.05$) for disease scores when used as paternal parents in the F₂, but differed strongly as maternal parents ($P = 0.0002$).

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Full Length Research Paper

A screening technique for resistance to *Fusarium* root rot of common bean

Clare M. Mukankusi^{1,2*}, Rob J. Melis¹, John Derera¹, Robin A. Buruchara² and D. Mark¹

¹African Centre for Crop Improvement, School of Agricultural Sciences and Agribusines, University of KwaZulu-Natal, P. Bag X01, Scottsville 5209, Pietermaritzburg, South Africa.
²International Centre for Tropical Agriculture (CIAT), P. O. Box 6247, Kampala, Uganda.

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Resistance to *Fusarium* root rot (FRR) in common bean is documented as a quantitative trait and as such is greatly influenced by several environmental factors. A reproducible disease screening technique that considers the selection environment is therefore important in selecting resistant lines. A study was conducted to evaluate soil composition and irrigation frequency on the severity of FRR, using a predominant pathogenic isolate from SW Uganda at the International Centre for Tropical Agriculture (CIAT) in Uganda. Five soil compositions (i) 80% lake sand:20% forest soil, (ii) 50% lake sand:50% forest soil, (iii) 80% swamp soil:20% forest soil, (iv) 50% swamp soil:50% forest soil and (v) forest soil alone), and five irrigation frequency levels (once a week, twice a week, three times a week, four times a week, and daily) were evaluated on six common bean varieties with varying levels of resistance to FRR. Forest soil and 50% swamp soil (soil composition); daily irrigation and irrigation once a week (irrigation frequency) differentiated test varieties most distinctly, according to their reaction to FRR. In conclusion, a combination of forest soil and daily watering using a pathogenic isolate FSP-3 provided adequate FRR disease levels for disease evaluation and differentiation of bean varieties and was adopted for genetic studies on FRR resistance in beans.

Key words: Common bean, *Fusarium* root rot, resistance, irrigation frequency, screening technique, soil composition.

INTRODUCTION

Fusarium solani (Mart.) Sacc. f. sp. phaseoli (Burkholder) Resistance to FRR and other polygenic traits is greatly

http://news.mak.ac.ug/documents/RUFORUM/Ob... mak.ac.ug Google Inbox (1992) - Yahoo! Mail

Second RUFORUM Biennial Meeting 20-24 September 2010, Entebbe, Uganda
Research Application Summary

Pyramiding *Fusarium* root rot resistance genes and validation of SSR PVBR87 in common bean

Obeta J. Bahabayo, P.R. Mukankusi, C. Gibson, P. Derera
¹Department of Crop Science, Makerere University, P.O. Box 7062, Kampala, Uganda
²International Centre for Tropical Agriculture (CIAT)-Africa, P.O. Box 6247, Kampala, Uganda.
Corresponding author: jannyobeta@gmail.com

Abstract This study determined effectiveness of pyramided *Fusarium* root rot (FRR) resistance genes and validated association of SSR PVBR87 marker with FRR resistance in common bean. A double cross (DC) involving four resistance sources was used to accumulate FRR resistance genes into one background. The DC F₁ and each resistant line were crossed to two susceptible cultivars. Parents, F₁ and F₂ populations were subjected to FSP-3 in a screenhouse. Two single cross (SC) F₁ populations were screened with SSR PVBR87 marker. Five-parent crosses performed better than single crosses. SSR PVBR87 marker showed association with FRR resistance in the two SC F₂ populations.

Key words: *Fusarium* root rot, FSP-3 (*Fusarium solani* f. sp. phaseoli isolate-3), gene pyramiding, SSR (simple sequence repeat)

Résumé Cette étude a déterminé l'efficacité des gènes pyramidés de résistance de la pourriture de racine de *Fusarium* (FRR) et a validé l'association du marqueur SSR PVBR87 avec la résistance de FRR dans le haricot ordinaire. Un double croisement (DC) impliquant quatre sources de résistance a été employé pour accumuler des gènes de résistance FRR au second plan. Le F₁ du double croisement DC et chaque lignée de résistance ont été croisés à deux cultivars sensibles. Les parents et les populations F₁ et F₂ ont été soumis à FSP-3 dans un milieu d'observation. Deux populations F₂ de simple croisement (SC) ont été examinées avec le marqueur SSR PVBR87. Les croisements de cinq parents se sont avérés mieux que les croisements simples. Le marqueur SSR PVBR87 a montré l'association avec la résistance FRR dans les deux populations F₂ de SC.

Mots clés: Pourriture de racine de *Fusarium*, FSP-3 (isolat

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Evaluating genetic association between fusarium and pythium root rots resistances in the bean genotype RWR 719

P. O. Ongom, S.T. Nkalubo¹, P.T. Gibson², C.M. Mukankusi³ and P.R. Rubaihayo

College of Agricultural and Environmental Sciences, Makerere University, P. O. Box 7062, Kampala, Uganda
¹National Crops Resources Research Institute (NaCRRI) Namulonge, P. O. Box 7081, Kampala, Uganda
²Department of Plants, Soils, and Agricultural Systems, Southern Illinois University, Carbondale, Illinois, USA
³International Centre for Tropical Agriculture (CIAT)-Uganda, P. O. Box 6247, Kampala, Uganda
Corresponding author's email address: ongom_patrick@yahoo.co.uk

Code Number: cs12011

ABSTRACT

Resistance to *Fusarium* root rot (*Fusarium solani* f. sp. phaseoli) has been reported in common bean (*Phaseolus vulgaris* L.) sources and is usually associated with *Pythium* root rot resistance. *Pythium* root rot (*Pythium ultimum* var. *ultimum*) resistance is controlled by a single dominant gene, marked by a SCAR marker PYAA1900. It remains unclear whether the inheritance to resistance of these two bean root rots is genetically independent. We evaluated the association of *Fusarium* root rot resistance with the *Pythium* root rots resistance gene and/or the molecular marker PYAA1900 in genotype RWR 719. Two populations; F₂ and F_{2,3} lines, generated from RWR 719 (resistant) × K132 (susceptible) were respectively screened with *Fusarium solani* and *Pythium ultimum* isolates, and root damages were scored based on the CIAT 1 – 5 scale. Additionally, the F_{2,3} lines were screened with PYAA1900. The F₂ segregation ratio deviated from a single gene model for reaction to *Fusarium solani*. The F_{2,3} lines fit the model for a single dominant gene that confers resistance to *Pythium ultimum*. *Fusarium solani* and *Pythium ultimum* resistances were inherited independently. There was lack of association between PYAA1900 and *Fusarium solani* resistance, but the PYAA1900 was strongly associated with *Pythium ultimum* resistance. This contradicts the assertion of linkage of the two resistances that was deduced based on the joint occurrence of both resistances in the available donor genotypes.

Key Words: Bean root rots resistance, *Fusarium solani*, molecular marker, *Phaseolus vulgaris*, *Pythium ultimum*

RÉSUMÉ

CIAT-RUFORUM students

Student	Level	Title	Status
Jimmy Obala	MSc	Improving resistance to Fusarium root rot through gene pyramiding and validation of SSR PVBR87 marker in common bean	Completed
Ongom Patrick	MSc	Inheritance of resistance to Fusarium root rot in three Pythium root resistant common bean genotypes	Completed
Kelvin Kamfwa	MSc	Quantitative trait loci discovery and transfer of resistance against Fusarium root rot in crosses of meso-american x Andean varieties of common beans (<i>Phaseolus vulgaris</i> L.).	Completed
Kiryowa Moses	PhD	Assessing the efficacy of pyramided genes in conferring dual and durable resistance to bean anthracnose and root rots	On-going
Ddamulira Gabriel	PhD	Genetic enhancement of resistance to Angular Leaf spot (<i>Pseudocercospora griseola</i>) in common bean (<i>Phaseolus vulgaris</i> L.) through gene stacking.	On-going
Floride Mukamuhirwa	MSc	Inheritance of higher seed content of iron and zinc in bean varieties grown in Rwanda. Floride Mukamuhirwa	On-going
Francis Okot	MSc	Phenotypic Diversity of Ugandan Pigeonpea Landraces and Their Reaction to Fusarium Wilt in Ugandan Environment	Completing
Nolipher Khaki	MSc	Evaluation of Malawian pigeon peas (<i>Cajanus cajan</i> L) landraces for drought tolerance and superior agronomic traits	Completing
Emma Uwera	MSc	?	New
Francis Ochaya	MSc	?	New

IMPACT OF CAPACITY BUILDING (MUK-CIAT)

- CIAT is a link that allows universities to translate research into development impact
 - Segregating populations developed by students through MAB are advanced by in-coming students (new projects)
 - Advanced lines are produced and distributed through CIAT's regional nurseries network to NARS
 - Two root rot varieties released in 2006-NAACRI
 - Publications draw international interest for more donor funding and new partnerships, e.g., USDA, BBSRC-UK projects based on root rot research
 - Increased capacity in Universities, and NARS