# Modeling and manipulation of plant-aphid interactions: A new avenue for sustainable disease management of beans in Africa

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Mosaic symptoms of BCMV/ BCMNV on susceptible bean variety

Black root symptoms on bean infected with BCMNV virus

**The development challenge:** Common Bean *(Phaseolus vulgaris L.)* is an important food crop in Eastern and Central Africa. Predominantly grown by women, it provides food and nutritional security, and income, to over 200 million people in sub-Saharan Africa. Significant challenges to production include aphid-transmitted disease caused by Bean Common Mosaic Virus (BCMV) and Bean Common Mosaic Necrosis Virus (BCMNV). While breeders are working to develop resistant varieties, sustainably tackling challenges unique to this pathosystem requires multiple resistance and management strategies.

**Potential impact:** Novel strategies of controlling bean virus diseases will be disseminated through the partnership, including the Pan-African Bean Research Alliance (PABRA) network across 29 African countries. Given the widespread distribution of these viruses, yield losses could be prevented for many millions of farmers across a wide geographic area. Further, the principles of manipulating insect vectors of plant viruses may be extrapolated to a broad range of important food and nutritional security crops.

## Outputs

1) A multidisciplinary, international scientific team coalesced around a difficult challenge constraining food and nutritional security in sub-Saharan Africa.

2) Genes differentially regulated in bean plants infected with BCMNV, BCMV and Cucumber mosaic virus (CMV) identified.

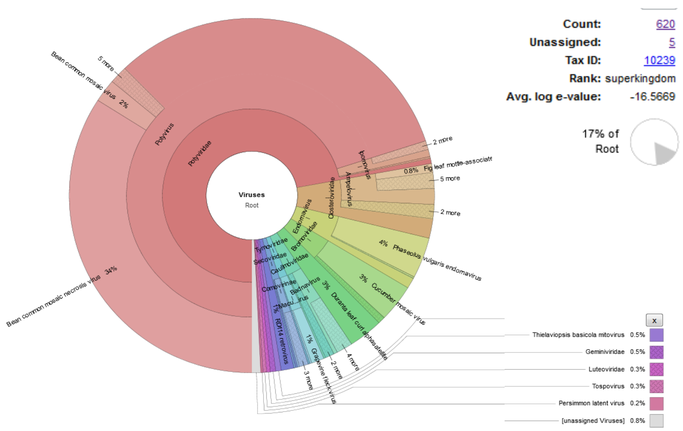
3) BCMNV was found to induce the greatest response in bean plants in terms of changes in gene expression compared to BCMV and CMV.

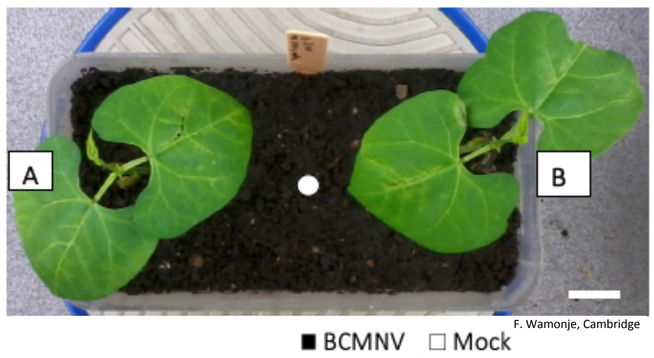
4) Genes involved in secondary metabolic pathways showed the greatest differential expression.

5) Validation of candidate genes for future manipulation and deployment (in progress)

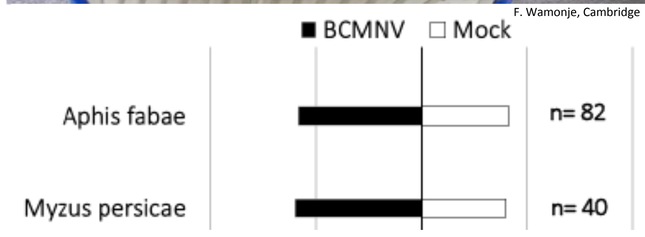
6) Sequenced BCMV, BCMNV and CMV from Kenya

7) Institutional and human capacity building, including training of African PhD at Cambridge University, and appointment of Minister of Agriculture and Livestock Resources (Rwanda) from the project team.




F. Wamonje, Cambridge




Aphids prefer virus-infected bean plants

## Expected outcomes

1) African national bean breeders developing resistant varieties using markers resulting from high-level genomic and epidemiological analysis of the pathosystem.

2) Farmers using bioscience-based interventions (improved varieties, semiochemical-based traps, push-pull systems) for increased yield and nutritional security.

3) Phytosanitary, regulatory, breeder and research actors using epidemiological models to curtail viral and aphid problems in a broader geographic context and wider set of crops.

4) NARS systems and stakeholders better equipped to tackle challenging crop improvement issues, incorporating high-end, appropriate biosciences.

5) Phytosanitary strategies for trade of beans can be adapted based on pathogen characterization, in order to safeguard regions from introduction of new, virulent strains; this includes safeguarding African smallholder farmers .

## Partnerships

1. BecA-ILRI Hub
2. University of Cambridge

(Broader project partners listed below)

## Potential to scale-up

1. Identification of the genetic basis of host resistance against viruses may be applied in the development of resistant cultivars to help reduce economic losses estimated to be at least US$ 400 million annually due to these viruses.
2. Information on molecular markers useful for selecting resistant cultivars or resistance genes will be disseminated through the BecA NARS network including the PABRA network across 29 African countries.
3. The principles of manipulating insect vectors of plant viruses may be extrapolated to a broad range of important food and nutritional security crops.

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