

Cluster annual report - 2018

CA3.6 – Responses to Biological Threats to Cassava in Africa



Bemisia tabaci (wired using 12.5 μm gold wire) feeding on the abaxial surface of cassava leaf (photo by M. Milenovic)

Morag Ferguson, James Legg and Everlyne Wosula



MAIN ACHIEVEMENTS

The major achievements in 2018 under CA3.6 relate to both **surveillance** and tracking of whitefly and the cassava brown streak disease (CBSD) pandemic threatening central and West Africa, and **innovations** to improve surveillance relating to the development of tools for efficient diagnostics and surveillance of whitefly, begomoviruses and cassava bacterial blight.

Surveillance

The continued spread of both Ugandan Cassava Brown Streak Virus (UCBSV) and Cassava Brown Streak Virus (CBSV) towards central and West Africa is highlighted through the first report confirming the occurrence of both UCBSV and CBSV in the north-eastern part of DRC. It confirms the continued westwards spread of the CBSIs that threaten cassava production in central and West Africa (13190).

The enormous increase in the volume, diversity and swiftness of movement of plant products throughout the world has led to a proliferation and dissemination of invasive species, particularly ones closely associated with plants, such as scale insects and whiteflies. Two Neotropical whitefly species, *Aleurotrachelus trachoides* and *Aleurotrachelus atratus* have been rapidly extending their range to other regions of the world. These two invasive whiteflies are recorded for the first time in Tanzania (15069). *Aleurotrachelus trachoides* was found colonizing sweet potato (*Ipomoea batatas*) in a greenhouse at Kibaha Research Station in the Coast region of Tanzania, while *A. atratus* found on palm (Arecaceae) in Arusha, Tanzania.

Tools for surveillance

Everlyne Wosula and James Legg of IITA describe the development of SNP-based diagnostic assay for cassava-colonizing *Bemisia tabaci* (4605). Different populations of whitefly exist with potentially different abilities to transmit viruses to cassava. Knowledge on whitefly population structure and distribution is essential in understanding the dynamics of virus severity and spread. Proper identification of cassava whiteflies is also essential in advancing control strategies such as the use of RNAi, as there is potential for efficacy to differ depending on whitefly genotype. Here, a robust diagnostic assay was developed without the need for sequencing. Six single nucleotide polymorphic (SNP) markers that distinguish six known populations were identified from the cassava whitefly genome. Primers were designed to amplify genome portions containing respective SNPs to be amplified using the Kompetitive allele Specific PCR (KASP) assay (LGC Genomics - UK). This KASP assay was developed based on limited whitefly collections that were from eight countries in Africa. We are currently testing whiteflies collected from 15 countries in Africa to optimize the assay. Once ready it will be deployed for use across laboratories in Africa that are involved in cassava whitefly research for rapid identification of populations.



IITA, under the NextGen Phytosanitation Project has developed a protocol for Rapid detection of cassava mosaic begomoviruses using Recombinase Polymerase Amplification (RPA) (12727). This assay can be utilized at local monitoring centers as it does not need nucleic acid extractions, but can utilize plant sap, with products ready for gel-based visualisation in 10-20min.

Continuing on the theme of diagnostics, CIRAD have developed a duplex-PCR for differential diagnosis of *Xanthomonas axonopodis* pv. *manihotis* and *Xanthomonas cassavae* in cassava (*Manihot esculenta*) (CA3.6.2.3 Novel diagnostics tools, surveillance and population structure of Xam).

Another study conducted by IITA reports the diversity of secondary bacterial endosymbiont in cassava-colonizing *Bemisia tabaci* whiteflies in Africa (12381). Cassava-colonizing whiteflies (*Bemisia tabaci*) are vectors of viruses that cause the most damaging cassava diseases in Africa, cassava mosaic disease (CMD) and cassava brown streak disease (CBSD). These whiteflies harbour secondary bacterial endosymbionts that have the potential to alter the biology and vector ability of the whitefly. The objective of this study was to determine endosymbiont diversity sampled from cassava in 12 countries in Africa. Three endosymbionts (Arsenophonus, Wolbachia and Rickettsia) were detected in 90% of the whiteflies either as single, double or triple infections. The most prevalent occurrence was double infection of Arsenophonus and Wolbachia. The distribution pattern compared to previous studies shows these endosymbionts are spreading in some whitefly populations. Further research is needed to determine the implication of these new developments on the biology and vector ability of the affected populations.

OUTCOME CASES AND POLICY INFLUENCED (PROPOSED)

Revise and complete the suggested list of outcome cases and policies to be documented

Title of Outcome/ Impact Case Report (OICR) (30 words)	Description (up to 80 words)	Geographic scope (Specify if regional, national, sub-national and provide list of regions/countries)
None to report		

Name and description of policies modified in design or implementation, informed by CGIAR research (20-50 words, ideally around 30 words)	Type (policies/ strategies / laws/ regulations/ budgets/ investments/ curricula)	Whose policy is this? The primary organization(s) either designing/promulgating the policy, law, investment (e.g. national government) etc. and/or within which it is operating.	Geographic scope (Specify if regional, national, sub-national and provide list of regions/countries)
None to report			

MAIN ACHIEVEMENTS WITH GENDER RELEVANCE

None to report



MAIN ACHIEVEMENTS WITH YOUTH RELEVANCE

None to report

MAIN ACHIEVEMENTS WITH CAPACITY DEVELOPMENT RELEVANCE

Surveillance of CBSD is being carried out by a PhD student in eastern DR Congo. Additionally, PlantVillage Nuru, the smartphone app that uses AI to identify cassava diseases, has been promoted with extension officers in Mkuranga District, Tanzania and Busia District, Kenya.

MAIN ACHIEVEMENTS WITH CLIMATE CHANGE RELEVANCE

The achievements highlighted above in terms of surveillance and development of tools to aid surveillance are all related to climate change. Climate change will have huge impact on the spread and distribution of pests and diseases as environments become more or less suitable for their proliferation.

MAIN GAPS AND CHALLENGES

One of the main challenges is getting scientists to report on their achievements, and upload deliverables to MEL.

Another challenge is the restrictive nature of this Cluster, limited by crop (cassava) and geographical region (Africa). This restricts access to cross-cutting RTB funding.

MEASURES TAKEN AND ADJUSTMENTS PROPOSED

Cluster leader to work closer with participating scientists to encourage uploading of proof of deliverables

PARTNESHIPS: ACHIEVEMENT AND CHALLENGES

Please list up to three important partnerships for 2018, using the following table.

Brief description of partnership aims (30 words)	List of key partners in partnership (one or more partners). Do not use acronyms.	Main area of partnership (may choose multiple), Research/Delivery/Policy/Capacity Development/Other, please specify
To develop and test PlantVillage Nuru, the smartphone app that uses AI to identify cassava diseases	Penn State University	Research and delivery

Please include collaborations with one or more CRPs or Platforms – or in some cases with other Centers, if these are not already core partners for your CRP.

Name(s) of collaborating CRP(s), Platform(s) or Center(s)	Brief description of the collaboration	Optional: Value added, in a few words e.g. scientific or efficiency benefits
Big Data	CA3.6 will expand its collaboration with the CGIAR BigData platform, in order to work together on ICT solutions for cassava pest and disease management in Africa.	

FUND RAISING

Give a narrative summary on the financial status and health of the cluster (all windows).

Provide an update on fund raising efforts.

MAX 1500 characters

ANNEX 1 – OUTPUTS TO BE REPORTED

Related output(s)	Output leader	Completed in MEL (YES/NO)
CA3.6.2.1 Surveillance of cassava virus pandemics in Africa	James Legg	Yes
CA3.6.2.2. New knowledge for the development of tools for efficient diagnostics and surveillance of <i>Bemisia tabaci</i> - a major pest and virus vector in root crops	Everlyne Wosula	Yes
CA3.6.2.3 CBB in Africa: Novel diagnostic tools, surveillance and population structure of Xam	Boris Szurik	Yes
CA3.6.4.2. Chemical ecology of cassava whiteflies	James Legg	Yes
CA3.6.4.3. Whiteflies-cassava genotype interactions	Apollin Fotso Kuate	Yes

ANNEX 2 – LIST OF FORMATIVE AND EVALUATIVE STUDIES

Title	Deliverable code
	Please make sure that the study has been uploaded in MEL