



# **NEW SPREAD OF CASSAVA BROWN STREAK VIRUS DISEASE AND ITS IMPLICATIONS FOR THE MOVEMENT OF CASSAVA GERMPASM IN THE EAST AND CENTRAL AFRICAN REGION**

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# **New Spread of Cassava Brown Streak Virus Disease and its Implications for the Movement of Cassava Germplasm in the East and Central African Region**

## **Background**

The East Africa Root Crops Research Network (EARRNET), a network of the Association for Strengthening Agricultural Research in East and Central Africa (ASARECA), and executed by the International Institute of Tropical Agriculture (IITA), wishes to bring to the attention of all stakeholders interested in the promotion of cassava in East and Central Africa that new reports of spread of cassava brown streak virus disease (CBSV) suggest that this disease now represents a significantly increased threat to the region's cassava.

CBSV is the second most important constraint affecting cassava production in eastern Africa after cassava mosaic disease (CMD). It is a devastating disease that causes loss of root production and quality. It can render susceptible varieties unusable if cassava roots are left in the ground for over nine months. Like CMD, CBSV is a viral disease, and is spread both through propagation of infected cuttings and by a whitefly vector, *Bemisia tabaci*. But, unlike the mosaic symptoms of CMD, the foliar symptoms of CBSV are less conspicuous and farmers are often unaware of the problem until the roots are harvested and the corky, yellow-brown necrotic rot becomes evident.

## **New spread**

Prior to 2004, CBSV had never been recorded at high incidence above 1000 m a.s.l., and was primarily known as a disease of the lowland cassava-growing areas of East Africa, including the shores of Lake Malawi. However, from late 2004 onwards it became apparent that CBSV was becoming more and more widespread in parts of south-central Uganda. Preliminary survey work confirmed the identity of the virus affecting cassava in Uganda to be the ipomovirus, Cassava brown streak virus (Alicai *et al.*, 2007).

An important feature of CBSV in Uganda is that incidence is highest and severity greatest in CMD-resistant varieties that are being promoted for the management of the CMD pandemic. This is most prominent for the two varieties TME 14 and TME 204 that have proved to be highly popular with farmers, and have therefore spread very rapidly within and between farming communities. Importantly, however, CBSV symptoms can also now be seen in diverse local cultivars, although in this case symptoms appear to be less severe. It also seems likely this 'new' spread of the virus causing CBSV is being enhanced by the super-abundance of the whitefly vector, *Bemisia tabaci*, a phenomenon that has been associated with the CMD pandemic. This suggests that all parts of the region already affected by the CMD pandemic with concomitant super-abundant whitefly populations may be particularly vulnerable to CBSV spread.

IITA and Uganda's National Agricultural Research Organization conducted a survey of cassava pests and diseases in January 2007 which incorporated an assessment of CBSV leaf symptoms for all of the 493 fields sampled through 26 of the most important cassava-growing districts in the country. CBSV was recorded from 40 of the fields, distributed virtually throughout the country, but with greatest incidence in south, central areas (fig. 1), corresponding to the area in which cultivation of TME and TME-like varieties is most widespread. Although almost 10% of all fields had CBSV infected plants, overall incidence was relatively low at 1.9%, although this was likely to be an underestimate since CBSV may be latent (i.e. some infected plants may be symptomless) and some varieties express symptoms in roots but not in leaves. In order to provide

a more authoritative estimate for CBSV incidence it would be necessary to combine assessments of both shoots and roots with tests of both symptomatic and asymptomatic plant tissues using virus diagnostics. Although such diagnostic protocols are available, they are not widely used, and the only African laboratory currently active in detecting and diagnosing CBSV is the MARI-IITA group at Mikocheni, Dar es Salaam.

In addition to these observations from Uganda, recent survey work in north-western Tanzania has shown that CBSV may be much more common than hitherto realized, with numerous occurrences reported from local cultivars using CBSV diagnostic tests (C. Herron, personal communication). In western Kenya, a significant 'outbreak' has also been reported from a large multiplication site in the Yala Swamp area of Western Province. Virtually all plants of the CMD-resistant variety MM96/5280 were infected. In south-western Democratic Republic of Congo (DRC), the disease continues to spread and root symptoms were reported at M'vuazi in regional trials on the varieties MM 96/0287, MM 96/7204, MM 96/7762, Nsansi, and RAV. Significantly, the last two varieties in this list are the most widely-grown released varieties in DRC. These observations highlight the regional threat posed by CBSD and emphasize the importance of having clearly-defined strategies for management both within countries and at the regional level.

### **Control approaches**

A Natural Resources Institute (NRI, UK) review mission carried out in 2005 concluded that whilst it was no longer possible to eradicate CBSD in Uganda, an eradication approach should be feasible for neighbouring countries and regions where similar conditions pertain such as western Kenya, north-western Tanzania, Rwanda, Burundi and eastern DRC. A first step, however, should be the survey of all introduced materials to determine whether or not CBSD is present, particularly in the varieties most commonly affected in Uganda: TME 204 and TME 14.

This situation has clear implications for germplasm exchange within the region. Recognizing the importance of this situation, EARRNET stakeholders requested the Network's co-ordination team to develop a statement addressed to the Committee of Directors of ASARECA on the appearance of the disease in the region and call for common action from all stakeholders to restrict the movement of cassava cuttings through the open quarantine system. As a part of this communication, it was proposed that only virus-tested tissue culture materials be used for inter-country cassava germplasm movements. Notably, the most recent introductions of germplasm to both Rwanda and Burundi, from the Kenya Plant Health Inspectorate Service (KEPHIS) Plant Quarantine Station at Muguga, Nairobi, and supported by EARRNET, have been in tissue culture form. Since 2005, and during the period of implementation of the C3P project, a number of new developments have been reported with respect to the disease's status in the region, as described previously in this document. Much remains to be done, however. Diagnostics capabilities remain virtually at the level at which they were prior to the new reports of CBSD spread, and the only location at which CBSV diagnostics are being routinely run is Mikocheni Agricultural Research Institute, Dar es Salaam. This is a significant limitation, as without diagnostics, national programme scientists and plant protection staff are unable to diagnose CBSV in apparently diseased samples or detect CBSV in tissue culture plants either coming into or going out of the country. Training activities conducted under C3P have provided an important opportunity, however, to raise the level of knowledge within the region of the disease, its symptoms and potential methods of control. These will be further supplemented by a planned EARRNET-IITA training workshop for researchers to be held in Dar es Salaam in June, 2007. IITA and NARS are actively involved in efforts to develop varieties with high levels of resistance to both CMD and

CBSD. Currently, however, there are few varieties available within C3P project target areas with recognized sources of CBSD resistance. As these are being sought and incorporated into new germplasm, interim measures will necessarily be limited to the promotion of those varieties that show some tolerance to CBSD and the phytosanitary 'clean-up' of multiplication blocks using symptoms as the basis for disease diagnosis.

Based on these observations, the following general recommendations can be made:

### **Short-term Recommendations**

- 1) Assess the health status, with respect to CBSD, of all C3P supported multiplication blocks and provide immediate alerts of any apparent cases of CBSD
- 2) Fast-track the multiplication of those varieties known to be tolerant to CBSD (e.g. in Uganda, Nase 3 and MH96/2961)
- 3) Over time, discourage the multiplication of those varieties known to be particularly susceptible to CBSD, such as TME 204, TME 14 and others (see above)
- 4) In Rwanda, Burundi, western Kenya, eastern DRC and north-western Tanzania – recommend the destruction of any plants, in any field, showing symptoms of CBSD
- 5) Tighten surveillance of border points (Rwanda – Uganda and Tanzania borders; DRC – Uganda border; Burundi – Rwanda and Tanzania borders; Tanzania – Uganda and Kenya borders; Kenya – Uganda border)
- 6) Continue to enforce the movement of cassava germplasm between countries only in virus-indexed tissue culture form
- 7) Extend training to all extension staff on the cause, symptoms and control of CBSD

### **Longer-term Research Needs**

Much of the current difficulty being faced in CBSV control stems from the very poor understanding of what the virus is, how it causes disease in plants and how it spreads. Substantially strengthened research efforts are urgently required to help fill the major gaps in knowledge of this disease. In addition, more resources are required for initiatives to develop control measures. Most important amongst these will be the urgent development, through breeding, of resistant varieties, and there is merit in pursuing both conventional and transgenic approaches in achieving this aim.

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## Symptoms of Cassava Brown Streak Virus Disease



Symptoms of Cassava brown streak virus disease on lower leaves of a susceptible cassava variety – Kibandameno (Kenya). Characteristics are an irregular yellow blotchy chlorosis that is most pronounced on lower leaves. Chlorosis is often also associated with secondary veins. In severe cases there may be leaf drying and shoot die-back



Symptoms of cassava brown streak virus disease in the roots of a susceptible cassava variety (Tanzania) The disease causes a dry corky rot that is most pronounced in the periphery of the root cortex. Symptoms range from pale yellow flecks to extensive areas of dark brown rot and become more severe as the plant ages



Cassava brown streak disease symptoms in roots of the susceptible variety, TME 204 (Namulonge, Uganda). Root constrictions and malformation are a common feature of severe CBSD.



Cassava brown streak disease leaf symptoms in TME 14 (Namulonge, Uganda). This image clearly demonstrates the association of chlorosis with secondary veins.

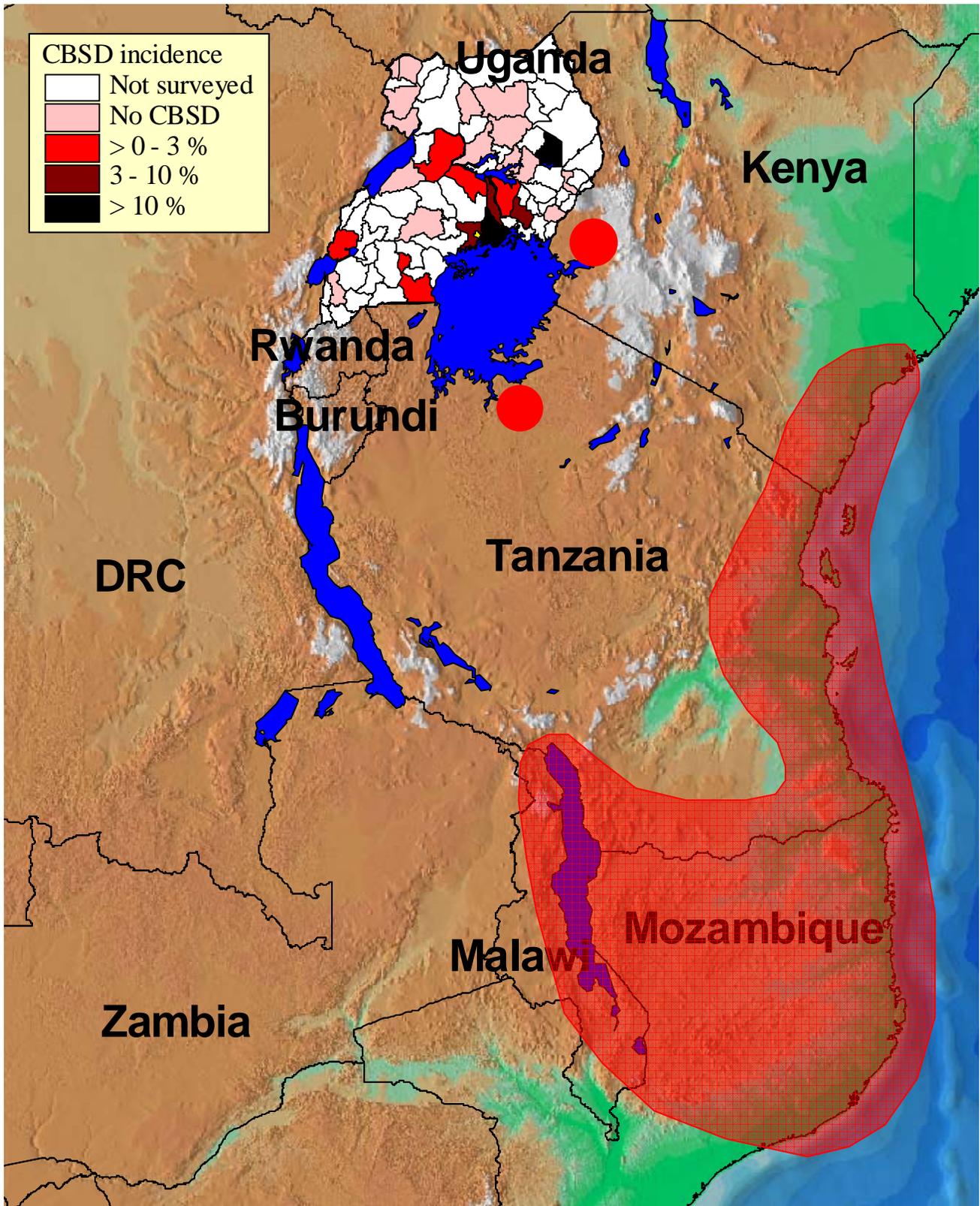


Fig. 1. CBSD in East and Southern Africa. Red zone is the area recognized as the primary CBSD-affected area. Red spots indicate new reports of CBSD. Recent spread of CBSD in Uganda has occurred since 2004.