



# Cassava brown streak disease

## *Cassava brown streak viruses*



Photo: Eric Boa, CABI, CC BY 4.0

*Typical dry brown rot is only evident when tubers are cut open.*



Photo: Eric Boa, CABI, CC BY 4.0

*Leaf symptoms are seen clearly here against the light, but are easy to miss when walking through fields.*

**SUMMARY:** Cassava brown streak disease (CBSD) has been known since the 1930s but has only recently become a major problem. Originally restricted mostly to the coastal regions of Tanzania and neighbours, an outbreak of this virus disease in the Great Lakes region in 2003 has since spread, particularly at higher altitudes (>1000 masl), to other countries in East and Central Africa. CBSD is not present in West Africa. CBSD is a serious threat to a key food crop. The leaf symptoms appear mild by comparison with the huge losses in tuber production: a dry brownish rot makes tubers unfit for eating and sale. CBSD occurs alongside cassava mosaic disease (CMD), another major threat to production caused by a different type of virus. Both diseases are spread by whiteflies and in infected planting material. Effective management depends on developing resistant varieties and making clean planting material available to farmers.

### KEY SIGNS

CBSD and CMD may occur in the same field and co-infect plants. Although often discussed together there are key differences between these two virus diseases. In CBSD leaf symptoms occur only on older or mature leaves, not on young expanding leaves, as in CMD. There is no leaf distortion with CBSD. Both virus diseases cause a patchy yellowing of leaves but in CBSD this is less intense. In CBSD yellowing occurs along the thin secondary veins that branch off from the main central vein. This can spread and form bigger patches, with a 'feathery' or 'blotchy' appearance.

The most distinctive symptom of CBSD is a dry rot of the tubers. Some plants may have leaf symptoms while tubers are unaffected. CMD affects tuber production but not the tubers internal appearance. Weakly growing cassava may have other fungal rots of tubers: look out for characteristic white threads (hyphae) on the outside of the tuber, though these may not always be present.

In CBSD-affected plants tuber rots begin with localised dead areas that are yellow-brown, with a cork-like appearance. The most susceptible cultivars have extensive rotting and tubers cannot be eaten. Some tubers have restricted growth, appearing like a series of rings stuck together. In some cultivars the tubers are affected but the leaves remain healthy.

Although the disease is named after brown streaks that occur on stems, these are of minor significance in terms of damage caused. The brown streaks are difficult to see and occur infrequently. CBSD infections may go undetected for long periods of time.

### MANAGEMENT

**Prevention** – what to do before signs are seen

*Cultural approaches:* Early detection, use of clean planting material and resistant cultivars are the major methods for managing CBSD.

Susceptibility to cassava brown streak viruses, of which there are two similar species, varies. Some cultivars are tolerant: they retain the virus but don't develop strong symptoms. Tolerant varieties, such as Garukunsubire and Seruruseke in Rwanda, limit losses locally but remain an important source of inoculum for new outbreaks. Cultivars described as resistant to CBSD are used in several countries, for example Kibaha, Rangi Mbili and Kasala in Tanzania. It is still not clear if these remain largely virus-free ('true resistance') or whether they are tolerant and still carry the disease.

Transgenic varieties resistant to CBSD and/or whiteflies are being developed and show promise. The added complication for plant breeders is that many of the existing CMD resistant cultivars are susceptible to CBSD.

**Control** – what to do after signs are seen

*Cultural approaches:* The removal of plants with typical CBSD leaf symptoms, known as roguing, is a useful means of limiting disease spread when only a few plants are affected. Symptomless plants may still contain the virus however, and roguing is no guarantee of successful elimination of CBSD.

It is important that neighbouring farmers collectively scout their fields, particularly when CBSD has been recently reported in an area. Effective surveillance and rapid responses are high priorities for ensuring that CBSD does not spread to new areas (e.g. West Africa). Making best use of advisory services and extension workers is part of a balanced strategy to improve early detection and responses.

*Chemical approaches:* Integrated control strategies include chemical vector control, but this will always be difficult and of limited benefit to farmers. First, controlling whiteflies is time-consuming and expensive. Second, it must be done regularly and effectively. Third, the greatest risk is in planting already infected material, for which there is no treatment. Once the virus is present in the plant there is no way to control the disease.

## CAUSE

There are two species of cassava brown streak viruses, both belonging to a type of potyvirus known as ipomoviruses. One is known as *Cassava brown streak virus* and the other as *Uganda cassava brown streak virus*. Both are transmitted by whiteflies and in infected planting material, which may show no symptoms of CBSD.

The pattern of spread of CBSD and CMD differs. CMD moves steadily in a distinct front, up to 100km in a year, similar to the ripples caused by throwing a large stone into a pond. CBSD has arisen in isolated areas (hot spots) then spread outwards, similar to the ripples from throwing several, smaller stones into a pond. This suggests the separate introduction of infected planting material across large areas.

The genetic diversity of CBSD viruses is not fully characterized and it is still unclear if the current epidemic is due to a new strain or species or some other as yet unidentified factor (see Impact).

## IMPACT

CBSD has a devastating effect on cassava production. Tubers are traditionally stored in the ground for long periods until needed, and the unexpected discovery that they are unusable greatly affects families expecting to eat or sell their crops. Losses of up to 60% in crop production (70% for the most susceptible varieties) have been reported from Malawi. The super-abundance of whiteflies has also directly led to major crop losses.

CBSD was observed in the 1940s and 1990s at a few locations in Uganda yet there was no apparent spread of the disease and certainly no pandemic. These earlier disease introductions (on breeding material) appear to have been successfully intercepted by researchers. It is possible that an increase in development efforts to mitigate the widespread effects of entrenched poverty and persistent conflict have inadvertently assisted in the distribution of infected planting material in East and Central Africa.

Whiteflies, the vectors of CBSD, appear less effective in passing the disease on to healthy plants compared to transmission of other virus diseases of cassava.

## DISTRIBUTION

CBSD has been confirmed from Tanzania, Mozambique, Kenya, Uganda, Rwanda, Burundi, Malawi, Equatorial Guinea, Zimbabwe and eastern DR Congo. Unconfirmed reports suggest it is present in Bas Congo. Mapping the distribution and spread of CBSD is made more difficult by the lack of distinct, above-ground symptoms.

## FURTHER READING

Plantwise Knowledge Bank ([www.plantwise.org/cpc](http://www.plantwise.org/cpc))

Crop Protection Compendium ([www.cabi.org/cpc](http://www.cabi.org/cpc))

FAO (2010). Cassava diseases in Africa: a major threat to food security. Strategic programme framework, 2010-2015. (available from: <http://www.fao.org/emergencies/resources/documents/resources-detail/en/c/171103/>)

Legg JP, Jeremiah SC, Obiero HM, Maruthi MN, Ndyetabula I, Okao-Okuja G, Bouwmeester H, Bigirimana S, Tat-Hangy W, Gashaka G, Mkamilo G, Alicai T, Lava Kumar P, 2011 Comparing the regional epidemiology of the cassava mosaic and cassava brown streak virus pandemics in Africa. *Virus Research* 159, 161-170