

A mosaic of submicroscopic entities causing big problems in cassava in Brazil

(Um mosaico de entidades submicroscópicas causando grandes problemas à mandioca no Brasil)

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Cassava (*Manihot esculenta* Crantz) is the third most important source of calories for human nutrition in the world. It is mainly propagated by stem cuttings and this practice led to dissemination of viruses and other systemic pathogens. In Brazil, at least three viruses were reported causing economic losses in cassava. *Cassava vein mosaic virus* (CsVMV; Caulimoviridae/ Cavemovirus) is widespread in the northeast semi-arid environment. CsVMV induces initial stunning on germinated stems, and as plant grows, leaves display a range of symptoms that includes a chlorosis along the veins, leaf distortion and epinasty of the young leaves. *Cassava common mosaic virus* (CsCMV; Alphaflexiviridae/Potexvirus), is widespread in Latin America, and in Brazil is prevalent in the southern/southeast regions. CsCMV infection interferes with the photosynthesis of plants and consequently with its development, and thus cause serious losses in root yield and the quality of the propagation material. Cassava frog skin disease (CFSD), was initially restricted to the Amazon region, but nowadays has been causing serious losses in southern plantations. Plants infected with this disease usually have no symptoms on the aerial part, while the tuberous root exhibited a woody appearance, thickened cork-like peel with opaque aspect, and coalescent lip-like slits in a honeycomb pattern. Severe affected plants do not show formation of tuberous roots, due to the absence of starch accumulation. The etiology of CFSD is complex because some authors attribute the disease to different species of viruses, such as Cassava frog-skin-associated virus (CsFSaV; Reoviridae/Oryzavirus), Cassava torrado-like virus (CsTLV; Secoviridae/Torradovirus), Cassava new alphaflexivirus (CsNAV; Alphaflexiviridae/Potexvirus), and Cassava polero-like virus (CsPLV; Luteoviridae/Polerovirus), and also with phytoplasma belonging to the 16SrIII-L and 16SrIII-A subgroups. Phytoplasma is also associated with cassava over budding disease. Infected plants show yellowing leaves, size reduction, over budding and roots has no commercial. The propagative nature of cassava favors that all these submicroscopic entities already reported, as well as others still under investigation, act in synergy to increase crop damage.