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Elevated viral small RNA profiling in cassava cultivars suppress the occurrence of Cassava brown streak disease (CBSD)

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Abstract

Cassava brown streak disease (CBSD), caused by cassava brown streak virus (CBSV) and; Ugandan cassava brown streak virus (UCBSV) causes the most destructive cassava disease in Tanzania. Thus, breeders urgently need CBSD-resistant cultivars to combat the impact of this disease, safeguard cassava production, improve the yields and secure food supply for communities reliant on this staple crop. In this study, we used four cassava cultivars; Albert, KBH 2002/135, KBH 2006/026 and Kiroba to explore how viral small interfering RNA (vsiRNAs), an antiviral silencing mechanism, confers CBSD resistance. Cassava plants were inoculated by grafting method using the single infection of CBSV, UCBSV and mixed infection of these viruses (co-infection). Total RNA was extracted from leaves of each cultivar followed by deep sequencing. The result showed that high level of vsiRNAs was produced in inoculated plants, with the most prominent class being 21 and 22 nucleotides. Kiroba produced the highest level of vsiRNA in both CBSV and UCBSV, whereas KBH 2006/026 produced high level of vsiRNA only with UCBSV infections. In contrast to UCBSV, inoculation with CBSV stimulated severe symptoms but relatively low levels of vsiRNA. Co-infection treatment showed a more complex interaction between the host and virus, with variations in the severity and amount of vsiRNA produced. We conclude that resistance to CBSD varies depending on the type of cultivar and virus species, and the occurrence of CBSD is suppressed in plants with elevated vsiRNA. Therefore, a good understanding on the resistance status of parental materials for breeding is recommended to breeders as a basis for improving cassava production.