

Novel Technologies for Disease Indexing and Screening for CSSVD Resistance

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Abstract

Cocoa swollen shoot virus disease (CSSVD) is one of the most enduring features of cocoa production in Ghana in particular, and West Africa in general. First recorded in 1938 in the Eastern region of the then Gold Coast, CSSVD is now present in virtually all cocoa growing areas of Ghana, as well as in neighbouring Togo, Nigeria, Cameroon and, possibly, in Côte d'Ivoire. The virus is indigenous to West Africa, present in forest trees and appears to have transferred to cocoa following the introduction of the crop. Crop losses due to the disease have affected the economies of countries like Ghana for which cocoa is an import export commodity. It has caused changes to the way of life of whole communities as they are forced to migrate, and the environment as forests are cleared for new farms. The prime control practice has been based on a "zero tolerance" philosophy which required that all infected trees and those in contact with them be removed. In Ghana, this has resulted in the destruction of millions of trees during the last 50 years, and many millions more are awaiting removal. With new farms getting rapidly infected, breeding for disease resistance has become imperative. Developments in biotechnology research have provided new tools to aid cacao breeders. These include the use of micropropagation techniques, particularly somatic embryogenesis, to produce large numbers of plants with identical genetic background, coupled with transformation protocols for cocoa transformation. Another is the development of new methods of virus inoculation and diagnosis, prerequisites for resistance screening. Molecular cloning methods have enabled the isolation of full-length infectious clones of severe isolates from Togo and Ghana. Mild isolates of the virus with potential uses in cross-protection have been isolated by the same method which enables researchers to overcome the low virus concentrations and/or low infectivity associated with them. These have been used to infect cocoa beans and young seedlings by particle bombardment and/or *Agrobacterium*-mediated micro-injection. With these tools, it is now possible to quantify virus inoculum used in challenging new cultivars in virus disease resistance breeding programmes. New CSSV-specific primers have been designed for disease indexing by polymerase chain reaction (PCR). Cloned virus DNA or cloned virus-coded PCR DNA products have also been used in virus disease indexing as labelled probes for DNA detection by Southern (1975) or dot blot hybridisation analysis. Ultimately, it is anticipated that the combination of new methods for generating large numbers of plants for inoculum delivery and virus detection will facilitate the development of new pest and disease resistant varieties for sustainable cocoa production.