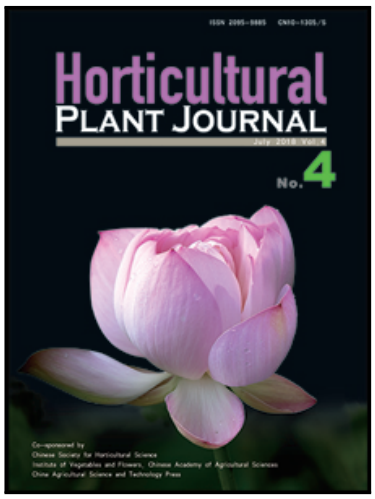

Banana Fusarium wilt (Fusarium oxysporum f. sp. cubense) Control and Resistance, in the Context of Developing Wilt-resistant Bananas Within Sustainable Production Systems

Siamak Shirani Bidabadi , Zheng Sijun

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Banana Fusarium wilt (*Fusarium oxysporum* f. sp. *cubense*) Control and Resistance, in the Context of Developing Wilt-resistant Bananas Within Sustainable Production Systems

Siamak Shirani Bidabadi[a] and ZHENG Sijun[b,*]

[a]Department of Horticulture, College of Agriculture, Isfahan University of Technology, IUT Isfahan, 84156-83111, Iran

[b]Agricultural Environment and Resources Institute, Yunnan Academy of Agricultural Sciences, Bioversity International-China, Kunming 650205, China

*Corresponding author. Tel.: +86 13629678561

E-mail address: s.zheng@cgiar.org

Abstract

Banana (*Musa* spp.) is seriously threatened by the soil-borne fungus *Fusarium oxysporum* f. sp. *cubense* (*Foc*), also known as Panama disease. Attempts to control Fusarium wilt with fungicides damage soil health and have limited efficiency due to pathogenic variability. Elucidating the mechanism of infection and molecular basis of host defense through banana genome sequencing, genome editing and proteomic profile analysis will help formulate strategies to develop resistant cultivars. This will include research to better understand the functions of *Fusarium* wilt-resistance proteins. Transgenic approaches and protoplast fusion could be employed as tools for transferring resistance genes from wild relatives to commercial banana varieties, and may serve as a new strategy in solving the problems faced by banana breeding programmes. Evaluation of banana germplasm for resistance to *Fusarium* wilt using *in vitro* mutation and selection, along with somaclonal variation and somatic hybridization, could improve banana breeding efficiency for resistance against *Foc*. Plant hormones could also play an important role in regulating plant growth and defense by mediating developmental processes and signaling networks involved in banana responses to *Foc*. A complementary approach for managing *Fusarium* wilt, such as exclusion, surveillance and biological control as important components of integrated disease management programs must be considered to prevent and contain contagion. This includes studies on banana plant-microbe interactions, embracing both plant growth promoting rhizobacteria (PGPR) to induce *Foc* resistance, and exploring *Foc*-derived elicitors for inducing defense-related enzymes in bananas. The role of Silicon and crop and livestock integration must also be included in the *Fusarium* control toolbox. The current review also gathers knowledge of the biotechnological approaches along with biological control of Fusarium wilt of banana that will provide researchers insights and criteria to develop future studies.

Keywords

banana; Fusarium wilt; *Musa*; sustainable production system; *Foc*

1. Introduction

Banana (*Musa* spp.) is a key staple (sub)tropical food and fruit. Most cultivated bananas are seedless triploid varieties (2n = 3x = 33) derived from intra- or inter-specific crosses between two diploid wild species, *M. acuminata* (genome designated AA) and *M. balbisiana* (BB) (Simmonds and Shepherd, 1955; Heslop-Harrison and Schwarzacher, 2007). The most common varieties of dessert and East African Highland bananas are triploid AAA derived from crosses within *M. acuminata*, while common cooking triploid bananas (AAB or ABB) derive from crosses between *M. acuminata* and *M. balbisiana*. Wild diploid banana produces seeds, whereas cultivated triploid banana is sterile, but develops parthenocarpic fruits (Li et al., 2013). Global banana