



Article

A Method for Selection of Coffee Varieties Resistant to *Fusarium stilboides*

Getrude Okutoyi Alworah ¹, Joshua Ondura Ogendo ², Joseph Juma Mafurah ², Elijah Kathurima Gichuru ^{1,*}, Douglas Watuku Miano ³ and Otieno Oliver Okumu ³

¹ Department of Plant Pathology, KALRO-Coffee Research Institute, P.O. Box 4, Ruiru 00232, Kenya; getrude.alworah@kalro.org

² Department of Crops, Horticulture and Soils, Egerton University, P.O. Box 536, Egerton 20115, Kenya; jogendo@egerton.ac.ke (J.O.O.); joseph.mafurah@egerton.ac.ke (J.J.M.)

³ Department of Plant Science and Crop Protection, University of Nairobi, P.O. Box 29053, Kangemi 00625, Kenya; dmiano@uonbi.ac.ke (D.W.M.); oliverotieno182@gmail.com (O.O.O.)

* Correspondence: ekgichuru@gmail.com or elijah.gichuru@kalro.org

Abstract: *Fusarium* bark disease (FBD) of coffee caused by *Fusarium stilboides* Steyaert has been associated with yield losses and tree death in coffee-growing countries, including Kenya. Varietal resistance is of utmost importance in managing the disease, and the continued increase in host resistance is considered sufficient to control the disease. Therefore, this study investigated the response of four coffee cultivars to *F. stilboides*. Fifteen hypocotyls from *Coffea arabica* (Ruiru 11, Batian and SL 28), plus two other coffee species, *Coffea canephora* (Robusta coffee) and *Coffea liberica* (Liberica coffee), were inoculated with various concentrations of three *F. stilboides* isolates (NRF 930/18, TN002B (I), BS008B (A)) using both the injection and drenching methods. The stem injection method was performed by injecting one microliter of the *F. stilboides* spore solution into the hypocotyl. In the drenching method, coffee seedlings had their roots cut and transplanted in a transplanting mixture, after which 10 mL of the *F. stilboides* spore solution was applied to the soil surface in each pot. The inoculated hypocotyls were incubated at 24 ± 2 °C for 105 days. The plants were watered regularly as necessary while the development of symptoms was observed and assessed weekly. Disease severity was evaluated using a modified scale of 0–4, while incidence was scored as a percentage of infected seedlings. Coffee seedlings inoculated with *F. stilboides* developed symptoms such as wilting, stunted growth and defoliation. In the first season, the coffee cultivars of Ruiru 11 and Liberica inoculated with *Fusarium stilboides* had pronounced severity compared to other cultivars. In the second season, the coffee cultivars Batian and Ruiru 11 had pronounced severity compared to other cultivars. The isolate TN002B (I) was observed to be highly virulent as compared to other isolates. The variation in response to disease infection exhibited by the four cultivars presents a key input in breeding programs for resistance to *F. stilboides*.

Keywords: *Fusarium*-bark disease; inoculation; resistance; pathogenicity; severity



Citation: Alworah, G.O.; Ogendo, J.O.; Mafurah, J.J.; Gichuru, E.K.; Miano, D.W.; Okumu, O.O. A Method for Selection of Coffee Varieties Resistant to *Fusarium stilboides*. *Agronomy* **2023**, *13*, 2321. <https://doi.org/10.3390/agronomy13092321>

Academic Editor: Sambasivam Periyannan

Received: 30 July 2023

Revised: 19 August 2023

Accepted: 25 August 2023

Published: 5 September 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Coffee production in Kenya is concentrated in the Western, Rift Valley and Central regions in the high potential areas between 1400 and 2200 m above sea level (masl) with temperatures ranging between 15 and 24 °C and red, deep, and well-drained volcanic soils [1]. Worldwide, the coffee tree is affected by several fungal diseases from the genera *Colletotrichum*, *Hemileia* [2] and *Fusarium* [3], causing yield losses directly or indirectly. Coffee bark disease, also known as “*Fusarium* bark disease”, is a serious and destructive disease of coffee. The disease is caused by the soil-borne fungus, *Fusarium stilboides*, the asexual stage (anamorph), the sexual stage (teleomorph) being *Gibberella stilboides* [4,5]. The disease mainly infects coffee plants through wounds, especially those caused during pruning and mechanical weeding. It requires humid conditions and an optimum temperature of 30 °C