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Screening rhizobacteria for biological control of *Fusarium* root and crown rot of sorghum in Ethiopia

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Abstract

Fusarium oxysporum Schlectend causes root and crown rot in several crops including sorghum that results in low grain yield in Ethiopia and other East African countries. Seventy-eight bacterial isolates were obtained and subsequently tested both *in vitro* and in the greenhouse. Of the 78 isolates tested, 23 displayed between 30 and 66.3% inhibition of *in vitro* mycelial growth of *F. oxysporum* and also showed significant root colonization ability on sorghum seedlings. These isolates were further tested for their biocontrol ability against *F. oxysporum* in the greenhouse. Four isolates viz. KBE5-7, KBE5-1, KBE2-5 and NAE5-5 resulted in 100% disease suppression and no symptoms of root and crown rot were observed compared to the control. The complete suppression of *F. oxysporum* by these isolates was also confirmed by root plating on Fusarium-selective medium. The most effective isolates were identified by means of the API system as members of the Genus *Bacillus* including *B. cereus*, *B. subtilis*, *B. circulans*, *B. licheniformis* and *B. stearothermophilus*. Two other isolates, which colonized the sorghum rhizosphere and resulted in more than 70% disease suppression, have been identified as *Chromobacterium violaceum*. The study demonstrated effective biological control by the rhizobacterial isolates tested, thereby indicating the possibility of application of rhizobacteria for control of soilborne diseases of sorghum in Ethiopia and other countries.
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Keywords: Plant growth promoting rhizobacteria; *Fusarium oxysporum*; *Bacillus cereus*; *B. subtilis*; *B. circulans*; *B. licheniformis*; *B. stearothermophilus*; *Chromobacterium violaceum*; Biocontrol; Sorghum; Root colonization; *Fusarium* root and crown rot

1. Introduction

Sorghum (*Sorghum bicolor* (L.) Moench) is ranked second among the five most important crops in East Africa (Food Agricultural Organization, 1999) and it is a staple food crop in arid and semi-arid areas in Ethiopia. The crop grows under a wide range of ecological conditions and is drought tolerant. Production is, however, very low in this country because of, amongst other factors, diseases caused by phytopathogenic fungi. Symptoms such as seedling death and root rot a few weeks after planting are commonly observed in the major sorghum fields.

Several members of the Genus *Fusarium* cause root diseases in sorghum leading to serious yield losses. Among the major pathogens in this group are *Fusarium oxysporum* Schlectend, *F. moniliforme* J. Sheld, *F. graminearum* Schwabe and *F. tricinctum* (Corda) Sacc. (Forbes et al., 1986). Most of the fungal pathogens reported on sorghum are found predominantly in Ethiopia and other East African countries (Huluka and Else, 1992).

In Ethiopia, repeated attempts have been made to control *Fusarium* root rot in sorghum with fungicidal treatments using, amongst others, benomyl. However none of the fungicides used have been successful mainly because of their phytotoxicity (Benhamou, 1992). Chemical control of sorghum diseases is also unaffordable in most developing countries. The use of broad-spectrum

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