Journal of Global Biosciences
ISSN 2320-1355
Volume 6, Number 6, 2017, pp. 5046-5049
Website: www.mutagens.co.in

Research Paper

TECHNICAL SHEET OF ANTIMICROBIAL ACTIVITY OF *Bacillus subtilis* GA1 ON THE GROWTH OF FUNGI SPOLIAGE OF IVORY COAST MANGOES

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Abstract

Mango (*Mangifera indica Linn.*) is an important tropical fruit because of its favorable flavour and high marketing value. However, diseases caused by various pathogens usually result in great economic losses in harvested mango fruit. The objective of this work is to determine the inhibitory properties of the bacterial strain *Bacillus subtilis* GA1 on Keith mangoes for altering germs in order to improve their shelf life. The inhibitory properties of *B. subtilis* GA1 have been identified by direct confrontation *in vitro* and *in vivo*. Fungi were identified mainly on mangoes altered as healthy with a 100 % attendance with *Colletotrichum* sp. and 70 % with *Aspergillus* sp. *Colletotrichum* sp. caused the greatest alteration Keith mangoes alteration with a diameter of 54.2 mm in three days *in vitro* inhibitory activity of the cell of *B. subtilis* GA1 showed a strong inhibition of the fungi with a mean of 72.78 %.

Key words: Alteration Mango, *Bacillus subtilis* GA1, Antifungal properties, Conservation.

INTRODUCTION

In Ivory Coast, the main production region of mango (L.) is in the region of Korhogo about 700 km from Abidjan**.** Fruit farming sector is seen as the engine of economic growth in the northern region with annual production estimated at 100 000 tonnes [1]. However, only 10 000 tonnes of mangoes are exported to the European market. The Ivorian mango production is threatened by huge phytosanitary issues related to attacks flies and mushrooms. Anthracnose is the second cause of the losses encountered in the production and conservation of mangoes, the officer is *Colletotrichum gloeosporioides* [2]. Application of synthetic fungicides is the major approach for control of fruit diseases for example, hot benomyl dips have been reported to effectively control anthracnose of harvested mango fruit [3]. In the mean-time, using fungicides at high concentrations over a long time can result in pathogen resistance [4]. The utilisation of chemical pesticides can cause problems of public health. Additionally, public concern

about fungicide residues is urging researchers to find new technologies for fruit disease control. So, Gram-positive bacteria, including *Bacillus* subtilis, produce a variety of antibacterial and antifungal metabolites, such as zwittermicin-A, kanosamine and cyclic lipopeptides (LPs) [5]. Cyclic lipopeptides have well potential in biotechnological applications because of their biosurfactant properties. Biosurfactants have numerous beneficial qualities including non-toxic, non-hazardous, biodegradable, environmental friendly, selective, effective under extreme conditions, numerous industrial applications, and unique surface-active properties. The main objective of this study was to determine the biologic activity of *Bacillus subtilis* GA1 on the microorganismes responsible for the change of the mangos.

MATERIALS AND METHODS

Materials

Hundred three samples of mangos varieties Keith altered and unaltered were collected from markets of fruit in Plateau (Abidjan, Cote d'Ivoire. *Bacillus subtilis* strain GA1 comming of the collection of Walloon Center of Industrial Biology (CWBI) of the University of Liege Gembloux Agrobio Tech (Belgium).

RESULTS AND DISCUSSION

Fungi were isolated and identified as follows (Table 1). Two mildews isolated and identified on mangos were *Colletotrichum* sp. and *Aspergillus* sp. *Colletotrichum* sp.were isolated on all healthy (100 %) and altered (100 %) mangoes. Also, *Aspergillus* sp. was isolated from healthy (60 %) healthy and altered mangoes (80 %). In the same way, two yeast isolated and identified on mangoes. A variant of *Candida* sp. was isolated only on 60 % of the mangos altered and the on 40 % of the healthy mangos respectively.

Table 1 : Funga l pathogens isolated of Keith mangos

Fungal pathogens	Number and positives samples percentages (%)		
	Altered mangoes (n = 5)	healthy mangoes (n = 5)	Total (n=10)
Candida sp.(s)	0 (0)	2 (40)	2 (20)
Candida sp.(a)	3 (60)	0 (0)	3 (30)
Aspergillus sp.	4 (80)	3 (60)	7 (70)
Colletotrichum sp.	5 (100)	5 (100)	10 (100)

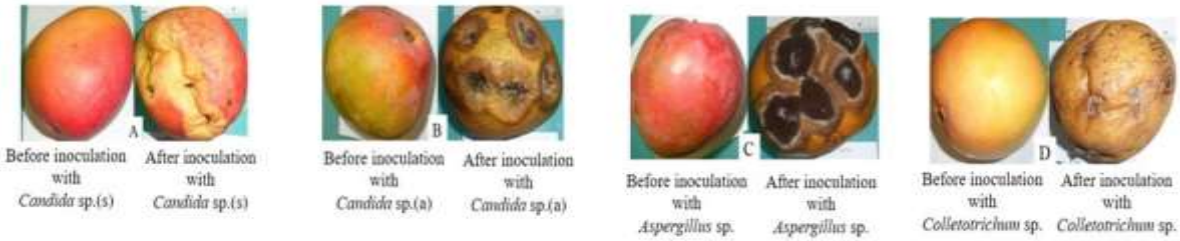

Figure 1. Aspect mangoes after artificial inoculation with Fungal pathogens isolated

Table 2: Lesion diameters (mm) induced by fungi isolated after 3 days of treatment

Fungal pathogens	Diameters of lesions (mm)
Candida sp.(s)	23
Candida sp.(a)	26.8
Aspergillus sp.	38
Colletotrichum sp.	54.2
Candida sp.(s) and *Candida* sp.(a)	40.2
Aspergillus sp. and *Colletotrichum* sp.	55.6
All fungi isolated	61

The pathogens were recovered and re-isolated from the infected tissue, thus proving that these fungus are the infectious agent in these fruits. The treatment of mangoes with cell of *B. subtilis* GA1 helped to reduce spoilage of mangoes (Figure 2).

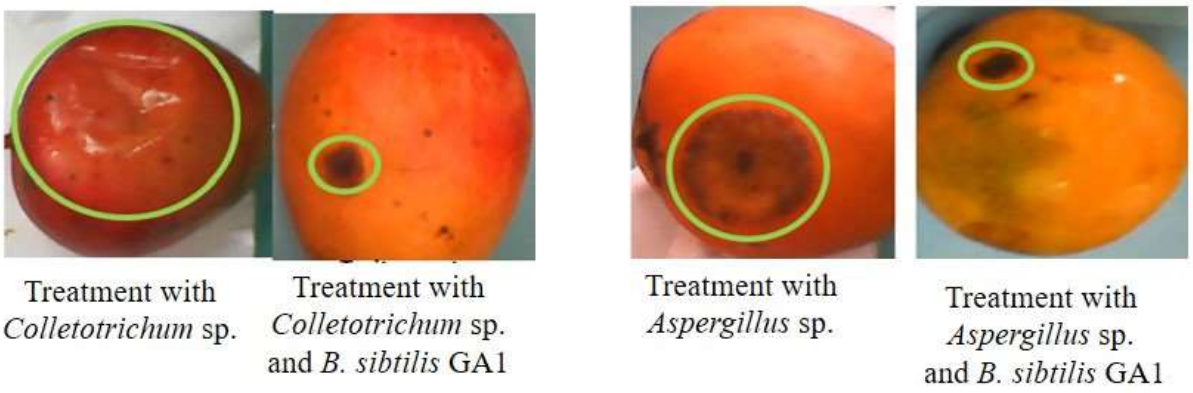

Figure 2. Biocontrol with biomass of *Bacillus subtilis* GA1 mangoes

Microbiological analyzes of samples of mango Keith variety from Abidjan market have shown three genus. These fungi could come from contact with the soil mango, harvest equipment and/or subsequent manipulations. According the presence of *Candida* sp. could be due a humane contamination because usually they are habitat mucous membranes, skin and nails. The presence of *Aspergillus* sp. on mangoes would have occurred during storage because they are mushrooms encountered during food storage [7]. The abundant presence of *Colletotrichum* sp. on Keith mangoes come from contamination from the fields through transport until mangoes storage [7].

CONCLUSION

The study confirm the potential of *B. subtilis* for the control of post-harvest diseases already reported for other fruits. From a technological point of view, the efficacy of

endospores is interesting as they are more stable than vegetative cells and maintain viability for years under appropriate storage conditions of the product.

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