In vitro control of plant pathogens by using anti-fungal hydroxy fatty acid obtained from microbial bioconversion of linolenic acid

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Abstract

Bioconverted linolenic acid (bLNA) obtained from linolenic acid by *Pseudomonas aeruginosa* PR3, showed anti-fungal activity against plant pathogens such as *B. cinerea, F. oxysporum, F. solani, P. capsici* and *C. capsici.* The oil sample also showed anti-fungal activity with MIC values, ranging from >250 to >1,000 μg/ml. Varied concentrations of bLNA had a great potential effect on spore germination of different fungi.

Introduction

The hydroxyl group on fatty acid is well known to give fatty acid special properties, such as higher viscosity and reactivity compared with other normal fatty acids so that the hydroxy fatty acids are used in a wide range of industrial products. We are reporting here the industrial potential of hydroxylated linolenic acid(s) by determining the anti-fungal activity against a range of phytopathogens.

Materials & methods

Microorganisms : *P. aeruginosa* PR3, kindly provided by Dr. Hou in USDA, was grown at 28℃ aerobically at 200 rpm on standard medium containing per liter 4 g dextrose, 2 g K_2HPO_4, 2 g $(NH_4)_2HPO_4$, 1 g NH_4NO_3, 0.5 g yeast extract, 0.014 g $ZnSO_4$, 0.01 g $FeSO_4 \cdot 7H_2O$ and 0.01 g $MnSO_4 \cdot 7H_2O$. Fungal strains were obtained from Korean Agricultural Culture Collection, Korea.

Bioconversion : Bioconversion was carried out in standard medium as mentioned

above. Linolenic acid as substrate was added to a 24 hour old culture followed by continued incubation for an additional 72 h. The culture broth was acidified to pH 2 with 6N HCl followed by immediate extraction twice with an equal volume of ethyl acetate and diethyl ether. The solvent was evaporated from the combined extract with a rotary evaporator and bioconverted oil extracts of linolenic acid were obtained.

Results & discussion

The bLNA showed great potential of anti-fungal activity against *B. cinerea (67%), F. oxysporum (52%), F. solani (43%), P. capsici (54%)* and *C. capsici (58%)* as fungal mycelium inhibition and MIC values of bLNA against the fungus were in the range of >250 to >1,000 (Table 1). bLNA at the concentration of 500 μg/ml, showed up to 100% spore germination inhibition against the fungus *B. cinerea and F. solani* and 50% to 90% at the concentration range of 400 to 500 μg/ml for rest of the fungus.

Fungal Strains	Mycelial Growth (mm)	Mycelial Inhibition (%)	MIC (μg/ml)
Rhizoctonia solani	45	nd[a]	na[b]
Botrytis cinerea	15	67	>250
Fusarium oxysporum	22	52	>500
Fusarium solani	26	43	500
Sclerotonia sclerotiorum	45	nd	>1000
Phytopthora capsici	21	54	>1000
Colletotricum capsici	18	58	500

nd[a] means no detection of anti-fungal activity
na[b] means not applicable

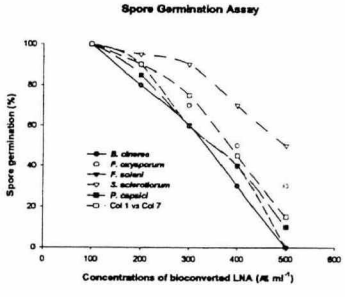

Fig. 1. Effect of different concentrations of bioconverted linolenic acid on spore germination of different fungi.

Conclusions

Our study can be considered as the potent report on the *in vitro* anti-fungal properties of bioconverted linolenic acid. These results suggest the availability of bioconverted crude oil of natural vegetable fatty acid for trials in controlling the incurable diseases caused by phytopathogens.

Reference

1. C. T. Hou, M. O. Bagby, Production of a new compound, 7,10-dihydroxy-8(*E*)-octadecenoic acid from oleic acid by *Pseudomonas* sp. PR3. Journal of Industrial Microbiology. 7 (1991) 123-130.