

Short Communication

THE INFLUENCE OF CHITIN FROM LOBSTER EXOSKELETON ON SEEDLING GROWTH AND MYCORRHIZAL INFECTION IN TOMATO CROP (*Lycopersicon esculentum* Mill)

R. Iglesias, A. Gutiérrez and F. Fernández

ABSTRACT. A seedbed experiment was carried out at the National Institute of Agricultural Sciences, using three tomato varieties: Manalucie, Roma and Campbell-28, powdering a cuban commercial chitin from lobster exoskeleton by hand onto the soil at the rate of 2 g.m^{-2} . Results showed a varietal response, Roma being an outstanding variety for its greater height, leaf number and fresh weight as well as a high index of mycorrhizal infection 30 days after seeding. This paper presents the stimulating effect of chitin on the high mycorrhizal infection of all varieties studied.

Key words: tomato, growth, chitin, vesicular arbuscular mycorrhizae

RESUMEN. En el Instituto Nacional de Ciencias Agrícolas se desarrolló un experimento de semillero con tres variedades de tomate, Manalucie, Roma y Campbell-28, aplicando al suelo quitina comercial cubana extraída de exoesqueleto de langosta, mediante espolvoreo manual a una dosis de 2 g.m^{-2} . Se encontró una respuesta varietal, destacándose la variedad Roma con una mayor altura, número de hojas y masa fresca, así como un alto incremento en las variables que caracterizan la infección micorrizógena a los 30 días de sembrado el semillero. Se discute el efecto estimulador de la quitina en la alta infección de micorrizas en las variedades estudiadas.

Palabras clave: tomate, crecimiento, quitina, micorrizas vesiculares arbusculares

INTRODUCTION

Chitin is widely spread in nature, making up the exoskeleton of insects and some crustaceans, such as lobster and shrimp, as well as the cell wall of fungus and yeasts. It is a very important compound for human medicine.

Chitin and chitosan oligomers encourage plant defence mechanisms against diseases (Walker and Ryan, 1984); as a soil amendment, increments were reported in tomato seedling growth, and soil concentrations of phosphorus, calcium and magnesium (Martez and Acosta, 1992).

On the other hand, chitin proved to be one of the natural compounds having a great potential for controlling *Meloidogyne* spp. population (Culbreath, Rodríguez-Kabana and Morgan, 1986).

The effect of chitin, as derived from lobster exoskeleton, on seedling growth and mycorrhizal infection (VAM) in three tomato varieties: Campbell-28, Roma and Manalucie, is evaluated in this study.

Dr. R. Iglesias, Investigador Titular y A. Gutiérrez, Investigador Agregado del laboratorio de Oligosacáridos, departamento de Fisiología y Bioquímica Vegetal; F. Fernández, Investigador Agregado del departamento de Biofertilizantes y Nutrición de las Plantas, Instituto Nacional de Ciencias Agrícolas, Gaveta Postal No. 1, San José de las Lajas, La Habana, Cuba.

MATERIALS AND METHODS

A seedbed was established in 5-m-long x 1.20-m-wide furrows at the rate of 1:2 (organic matter, filter cake and soil) in the optimal season, drilling seeds from three tomato varieties: Manalucie, Campbell-28 and Roma to obtain tomato seedlings.

Chitin was uniformly powdered onto the seedbed (2 g.m^{-2}) at 5, 10 and 15 days per treatment after seed germination besides a check control.

A randomized block design with four replications and ten plants per treatment as well as a control per variety was used, applying a two-way classification model for data statistical analysis, evaluating plant height, leaf number, shoot diameter, fresh and dry weights, percent native mycorrhiza and VAM matter (mg) 30 days after seeding (Herrera *et al.*, 1988; Giovanetti and Mosse, 1980; Philips and Hayman, 1972).

RESULTS AND DISCUSSION

Chitin increased seedling growth parameters in all varieties (Table I); however, there were varietal performance responses, Roma being an outstanding variety.

A mycorrhizal overgrowth in roots from chitin-treated seedlings is observed in table II, showing also a differential response between varieties, Roma being an outstanding variety too.

Table I. Growth parameters of chitin-treated seedlings of tomato

Variety	Treatments	Height (cm)	Leaf number	Shoot diameter	Fresh weight (g)	Dry weight (g)
Roma	chitin	28.39 a	4.71 a	0.31 a	15.17 a	0.97 a
	control	16.39 c	3.69 b	0.21 d	7.51 d	0.53 c
Campbell-28	chitin	18.04 b	3.40 c	0.28 b	10.83 b	0.67 b
	control	15.79 d	2.83 d	0.21 d	7.35 d	0.43 d
Manalucie	chitin	15.69 d	3.41 c	0.24 c	8.16 c	0.38 e
	control	15.10 e	2.71 d	0.18 e	5.65 e	0.18 f
ES x		0.177***	0.041***	0.006***	0.055***	0.010***

Means having common letters do not differ significantly, according to Duncan's multiple range test at 5 %

Table II. Root mycorrhizae in chitin-treated seedlings of tomato

Variety	Treatments	Mycorrhizal infection (%)	VAM (mg)
Roma	chitin	65.75 a	69.14 a
	control	25.32 e	4.89 d
Campbell-28	chitin	54.58 b	24.33 b
	control	19.07 f	3.85 e
Manalucie	chitin	52.20 c	14.11 c
	control	28.48 d	2.87 f
ES x		0.274***	0.144***

Martez and Acosta (1992) found that ground shrimp shell used as soil amendment at any dose or at 10 % v/v or 5 to 35 days before transplanting, raised soil pH and increased seedling growth, and soil contents of phosphorus, calcium and magnesium.

Mycorrhizae are known to enlarge the uptake of P, Zn and Cu elements whose ionic forms are relatively insoluble in soil solution, and the hydraulic conductivity of roots (Graham and Syversten, 1984), a mechanism which might enhance drought tolerance of plants (Allen *et al.*, 1981), transpiration rates and photosynthesis (Johnson, 1984).

There is evidence that an increased mycorrhizal symbiosis is closely related to plant resistance against pathogenic nematodes and fungi in roots and shoots (Schenk, 1981).

Mycorrhizal outgrowth in roots from chitin-treated plants promotes a natural infection as a result of polymer-degrading products in the soil, either by microorganisms of such a habitat or by roots (Roby, Gadelle and Toppan, 1987).

The varietal difference of parameters accounting for mycorrhizal infection is partly due to a different performance with respect to a constitutive chitinase activity in roots from three varieties, it involving differences at polymer degradation in soils.

The possibility of chitin or its degradation products to constitute an essential biochemical signal for the establishment of infection in the host-symbiont interac-

tion suggests the need to undertake some research works devoted to an optimal application of this biofertilizer and to elucidate all specific functions of these products, for attaining an axenic culture of mycorrhizae. Those studies will surely have an economic impact, for its implications in nutrition, seedling progress in the seedbed and crop protection, among other factors.

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