

TEMPERATURE AND PH INFLUENCE ON ANTAGONISTIC POTENTIAL OF *TRICHODERMA* SP. STRAINS AGAINST *RHIZOCTONIA SOLANI*

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Abstract

Species of the genus *Trichoderma* sp. are considered as potential biocontrol agents (BCA) for many plant diseases. The effectiveness of biocontrol agents depends on several parameters therefore their application showed consider climatic factor that could affect their biocontrol capacity. The present study examined the antagonistic potential of two *Trichoderma* sp. strains (Td85 and Td50) against *Rhizoctonia solani* depending on pH (4.5;5.5) and temperature (25°C, 30°C). Both strains of *Trichoderma* sp. studied inhibit stronger growth of *Rhizoctonia solani* at 30°C compared to 25°C. Also our results revealed that both strains of *Trichoderma* have maximum antagonistic ability to *Rhizoctonia solani* strain at pH=4.5.

Key words: climatic factors, biocontrol, inhibition percent

INTRODUCTION

Rhizoctonia solani is a soil pathogen that causes diseases in a wide range of hosts of agricultural, horticultural and ornamentals crops (Cundom et al., 2003). It can cause severe damage specially during the seedlings pre-emergence and post-emergence stages and is a limiting factor in the production of crops. Diseases caused by *Rhizoctonia solani* are difficult because this pathogen survives for many years as sclerotia or as mycelium in soil or organic matter under various conditions and has an extremely wide host range. (Osman et al., 2011).

Many important agricultural and horticultural crops worldwide are mostly affected by *R.solani* including tomato, bean, potato, strawberry, soybean, tobacco, tulip (Rahman et al., 2014; Seema and Devaki, 2012; Osman et al., 2011; Lahlali and Hijri, 2010, Grosch, 2007; Elad et al., 2006; Singh and Chand, 2006; Schneider et al., 1997; Tu et al., 1996).

Species of the genus *Trichoderma* sp. are considered as potential biocontrol agents (BCA) for many plant diseases (Galarza et al. 2015; Singh et al. 2013; Kohl and Schlosser 1989).

The effectiveness of biocontrol agents depends on several parameters, that include specific

pathogen, soil texture, water content, pH, temperature and crop history (Berg et al., 2005; Kredics et al., 2003), therefore their application should consider the environmental stress that could affect their ability to maintain their biocontrol capacity.

Although there are several publication on the antagonistic activities of *Trichoderma* sp., there is little information on the effects of pH and temperature on its antagonistic proprieties against *Rhizoctonia solani* (Daryaei et al., 2016; Lahlali and Hijri, 2010; Montealegre et al., 2009; Santamarina and Rosello, 2006).

The goal of this work was to evaluate the *in vitro* effects of different environmental conditions (temperature and pH) on the antagonism of *Trichoderma* sp. towards *Rhizoctonia solani*.

MATERIALS AND METHODS

One *Rhizoctonia solani* strain and two *Trichoderma* sp. strains (Td85 and Td 50) obtained from RDIPP culture collection were used in this experiment. These fungal strains were maintained at 4°C on Potato Dextrose Agar (PDA) with periodical subculturing on the same medium at 25°C.

Trichoderma sp. strains used in this experiment were identified at species level as *Trichoderma*

asperellum according molecular analysis(Paica et al., 2015).

Fungal isolates of *Trichoderma* sp. were *in vitro* screened for their ability to suppress the mycelial growth of *R. solani* in dual culture assays (Morton and Stroube, 1955).

Mycelial blocks (5mm) were cutted from the periphery of 5 days old culture of both *Trichoderma* sp. and *R.solani*. Two mycelial blocks one from *Trichoderma* and other from *R.solani* were placed in a same time on PDA (Potato Dextrose Agar) plate in opposite directions and incubated at two temperatures (25°C, 30°C) for 4 days. The radial growth of each colony was measured at 48.72 and 96 hours interval.

PDA with different pH levels (4.5 and 5.5) were poured into Petri dishes and a 5 mm plug from the margin of actively growing colony of *Trichoderma* sp. strains and *R.solani* were placed in opposite direction and were incubated at 28°C for 4 days.

Controls were also set up with the pathogen alone so that a growth without interactions could be precisely measured. Three replicates for each antagonist-pathogen combination and for the controls were considered. Percent inhibition of mycelial growth of targeted fungal pathogen over control was calculated by following equation:

$$\% \text{ inhibition} = \frac{C - T}{C} \times 100$$

C-colony diameter of pathogen in control plates

T -colony diameter of pathogen in dual culture plates

RESULTS AND DISCUSSIONS

A broad range of temperature tolerance for growth and sporulation of *Trichoderma* sp. is a very interesting feature for suitability of the antagonism.

A clear zone of interaction between antagonist and pathogen was observed after 48 h of incubation. The mycelium of both *Trichoderma* sp. strains grew abundantly on *R. solani* after 4 days of incubation.

Both *Trichoderma* sp. strains were able to significantly decrease the radial growth of *R.solani* mycelium within 4 days at both

temperature conditions. *Trichoderma* Td85 was more active against *R.solani* strain at 30°C compared to 25°C. Td85 limited growth of *R.solani* mycelium more than 57% at 30°C (fig.1). Also, Td85 strain was more effective at 25°C with a inhibition percentage of 54.48% compared to Td50 with a percentage of 53.33% (fig.1 and 2). Our results are in agreement with Grosch et al, (2007) who reported that most strains of *Trichoderma* sp. studied by them showed better antagonistic activity against *R.solani* at higher temperature (30°C).

Also, our results are in conformity with those of Montealegre et al., (2009) who suggested that low and high temperatures (between 5°C and 22°C) do not changes the biocontrol capacity of different *Trichoderma* sp. strains on *R.solani*.

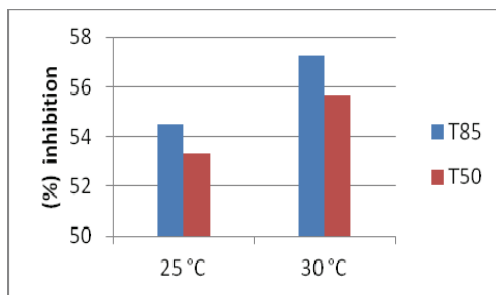


Figure 1. Effect of the temperature on the inhibition of the mycelial growth of *R.solani* in dual culture assay with *Trichoderma* sp. after 4 days of incubation

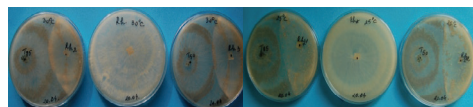


Figure 2 Antagonistic effect between *R.solani* and *Trichoderma* sp. at 30°C (left) and 25°C (right) after 4 days of incubation

Our results showed that both *Trichoderma* sp. strains were antagonistic to *R.solani* at both pH values although differences were found among strains. The data presented in fig.3 indicate that both *Trichoderma* sp. strains studied were effective in suppressing *R.solani* at pH=4.5 compared to pH=5.5.

At pH=4.5, no significant differences between the two antagonistic strains was observed regarding the percentages of inhibition (56%) of the mycelial growth (fig.3, fig.4). However at pH=5.5, Td85 strain had a slight increase of

inhibition percentage (53.72%) compared to Td50 (52.15%)

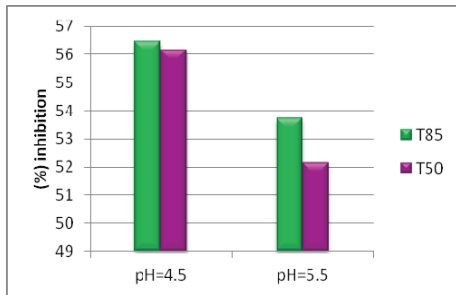


Fig. 3 Effect of pH on the inhibition of radial growth of *R. solani* in dual culture with *Trichoderma* sp. strains after 4 days of incubation

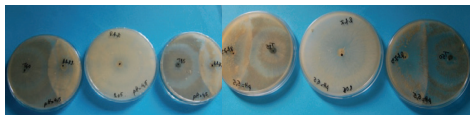


Fig.4 Antagonistic effect between *R.solani* and *Trichoderma* sp. at pH=4.5(left) and pH=5.5 (right) after 4 days of incubation

Results of Daryaei et al., 2016 suggest that at different pH values *Trichoderma atroviride* gave significantly various amount of inhibition and overgrowth activity against *R.solani* in dual culture assays with the strongest inhibition (76%) at pH=7.5. However Bagwan, 2010 reported that most favourable pH for maximum antagonistic potential of *Trichoderma viride* against *S. rolfsii* and *R.solani* ranged between 5.5 to 6.5.

CONCLUSIONS

The interaction between *Trichoderma* sp. and *R.solani* was dependent on temperature and pH. *Trichoderma* Td85 strain proved to be most effective with the highest percentage of inhibition at 30°C whereas Td50 strain showed lower inhibition at this temperature. Our results supported that the most appropriate pH for maximum antagonistic potential of tested strains was 4.5.

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