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Original Research Article

Effect of different *Trichoderma* Isolates on Growth Promotion of Tomato Seedlings under *invivo* (Greenhouse) Condition

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A B S T R A C T

Trichoderma species are commonly used as biological control agents against phytopathogenic fungi but some isolates are able to improve plant growth. In this study, the effects of five native isolates of *Trichoderma harzianum* along with Pusa strain *Trichoderma asperellum* in tomato seedling height, shoot fresh weight, shoot dry weight; root fresh weight and root dry weight via inoculants introduction methods (Bio priming) were examined. Seed germination rate was not affected by *Trichoderma* application, but seedling height, shoot fresh weight, shoot dry weight, root fresh weight and root dry weight in tomato seedlings were increased when seed bioprimed with *Trichoderma harzianum* and *asperellum* strain when compared to the control. Among the *Trichoderma* strains treatment, *T. asperellum* obtained significantly increase in seedling height (12.10cm), shoot fresh weight (11.23g), shoot dry weight (1.25g) and root fresh weight (1.49g) and root dry weight (0.33g) as compare to other treatments.

Keywords

Trichoderma harzianum, T. asperellum, Growth promotion, and Bio-priming

Introduction

The need for increasing agricultural productivity and quality has led to an excessive use of chemical fertilizers, creating serious environmental pollution. The use of biofertilizers and biopesticides is an alternative for sustaining high production with low ecological impact. In addition to the direct application of *Trichoderma* spp. as biocontrol agents in plant protection, recent studies have focused on the beneficial responses exerted on plants, stimulating the growth, activating the defenses, and/or improving nutrient uptake. Different soil-borne bacteria and fungi are able to colonize plant roots and may have beneficial effects on the plant. Besides the classic mycorrhizal fungi and Rhizobium bacteria, other plant-growth-promoting rhizobacteria (PGPR) and fungi such as *Trichoderma* spp. and *Piriformospora indica* can stimulate plant growth by suppressing plant diseases (Van Wees *et al.*, 2008). These micro-organisms can form endophytic associations and interact with other microbes in the rhizosphere, thereby influencing disease protection, plant growth and yield. Specially *Trichoderma* species, that are common inhabitants of the rhizosphere are biological control organisms

against a wide range of soil borne pathogens and also have been known to provide plant growth promotion. Individuals from the genus *Trichoderma* incorporate growths that are pervasive in about all soil kinds. They have the capacity to endophytically colonize roots and give an immense range of growth and development to plants. Parasitic species having a place with the family *Trichoderma* are basic filamentous blemished saprophytic organisms in soil and rhizosphere biological system that have been known not just for their capability to control several commercial phytopathogens that caused soil-borne yet additionally for their capacity to advance plant development (Harman *et al.,* 2004). *Trichoderma harzianum* Rifai have been known to show antagonism to various root pathogens such as *Pythium* spp., *Rhizoctonia* spp. and *Fusarium* spp. (Chet *et al.,* 1987).

Some strains of *T. harzianum* establish robust and long lasting colonization of root surfaces penetrating into the epidermis (Harman *et al.,* 2000) [4]. This colonization by *T. harzianum* frequently enhances root growth development, crop productivity and resistance to abiotic stresses through enhancement of mineral absorption. This study was carried out to investigate the effects *T. harzianum* in enhancing growth of tomato seedling.

Materials and Methods

Experimental site and materials

Investigations were carried out in greenhouse Department of Plant Pathology, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar.

The experiment was conducted under greenhouse conditions in plastic pots (2 kg capacity) were filled with sterilized well pulverized sandy-loam soil mixed with vermicompost (200g /pot). Seeds of tomato were bio-primed by treating them with the talc based preparations of *Trichoderma* isolates @ 5g/kg seed. Treated seeds were kept in a moist chamber for 24 hrs at room temperature (25±1°C) so that *Trichoderma* could sporulate and colonize the seed. Seeds of tomato (Jagannath tomato -3) bioprimed with selected *Trichoderma* isolate i.e. Th2, Th3, Th5, Th6, Th8 and T. *asperellum* @ 5g/ kg were sown in each pots (5 No. seeds in each pot).

The untreated seeds without any treatment kept as check. Watering of pots was done when required to maintain optimum level of moisture. The experiment was laid out in a completely randomized design with three replications

Experimental finding

In this experiment five native isolates of *Trichoderma* isolates along with University strain (*Trichoderma asperellum*) were tested under pot condition in the green house to test the growth promotion potential in tomato. Seed bio primed with *Trichoderma* isolates increased seedling height, fresh shoot & dry weight and fresh root & dry weight as compared to untreated control (Table 1).

Results and Discussion

Effect on seedling height

The data presented in table 1 indicates that after 45 days of sowing significant increase in seedling height was observed in seed bio primed with *Trichoderma* isolate *viz.,* Th2, Th3, Th5, Th6, Th8 and *T. asperellum* as compared to control (Fig 1, Plate-1). Among the *Trichoderma* strains treatment, *T. asperellum* obtained significantly higher seedling height (12.10cm) which was at par with Th-8 (11.49cm) followed by Th-3(10.93cm), Th-2(10.81cm), Th-6(10.76cm) and Th-5 (10.43cm).

Effect on fresh shoot and dry weight

Data in table 1 show that all the seed treatments significantly increased the fresh shoot weight after 45days of sowing. In *T. asperellum* (11.23g) significantly higher fresh shoot weight was noticed which was at par with Th-3 (10.67g) and Th-8(10.38) followed by Th-2(10.14g), Th-6(9.40g) and Th-5(9.08g). Seed treatment with all the *Trichoderma* isolate significantly increased the shoot dry weight as compared to control after 45 days of sowing.

Significantly highest shoot dry was obtained in *T. asperellum* (1.25g) which was at par with Th-8 (1.20 g) followed by Th-5 (1.15g) Th-2(1.11g), Th-3(1.08g) and Th-6(0.96g).

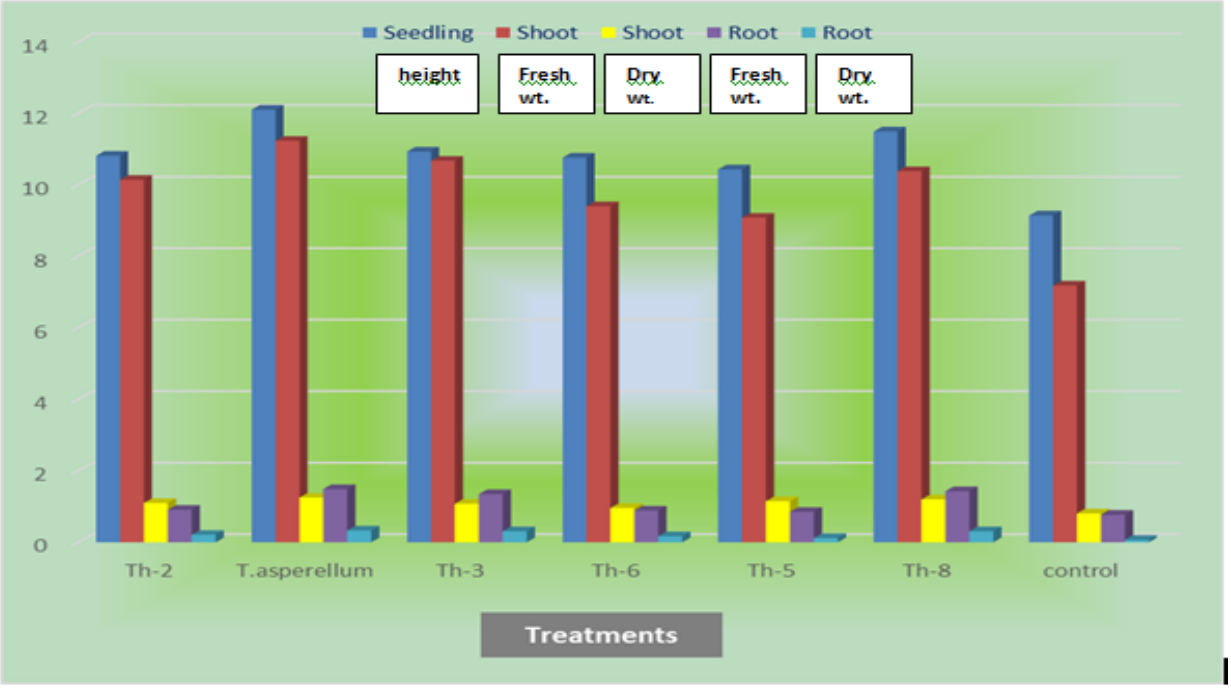
Table.1 Growth promotion effect of talc based preparation *Trichoderma* isolates on tomato seedlings *invivo* (greenhouse)

Treatment	Seedling height(cm)	Shoot		Root	
		Fresh weight (g)	Dry weight (g)	Fresh weight (g)	Dry weight (g)
Th-2	10.81	10.14	1.10	0.91	0.21
T. asperellum	12.10	11.23	1.25	1.49	0.33
Th-3	10.93	10.67	1.08	1.35	0.31
Th-5	10.43	9.08	1.15	0.85	0.12
Th-6	10.76	9.40	1.15	0.85	0.12
Th-8	11.49	10.38	1.20	1.43	0.31
Control	9.14	7.18	0.81	0.77	0.07
C.D. (P<0.5)	1.16	0.99	0.09	0.07	0.02
C.V	6.09	5.78	4.55	3.57	6.20

*mean of three replication

Plate.1 Effect of different *Trichoderma* isolates on plant growth promotion in tomato seedlings *invivo* (Greenhouse)

Fig.1 Efficacy of *Trichoderma* isolates on seedling height, shoot fresh & dry weight and root fresh and dry weight of tomato plant



Effect on fresh root and dry weight

Data in table 1 show that all the seed treatments significantly increased the root fresh weight after 45days of sowing. In *T. asperellum* (1.49g) significantly higher fresh root weight was noticed which was at par with Th-8(1.43g) followed by Th-3(1.35g), Th-2(0.91g) and Th-6(0.89g), Th-5(0.85g) and Th-6(0.89g).

Seed treatment with all the *Trichoderma* isolate significantly increased the dry root weight as compared to control after 45 days of sowing. Significantly highest dry root weight was obtained in *T. asperellum* (0.33g) which was at par with Th-8 (0.31 g) and Th-3 (0.31g) followed by Th-2 (0.21g), Th-6(0.17g) and Th-5(0.12g)

Trichoderma species are one of the most versatile opportunistic plant symbionts which can colonize plant roots (Brotman *et al.*, 2013). Although, the plant-growth-promoting capability of *Trichoderma* spp. has been previously reported. The *Trichoderma* segregates alongside University strain *Trichoderma asperallum* were tried in the glass house to test the development advancement. All the *Trichoderma* isolates fundamentally expanded the seedling height, shoot fresh and dry weight and root fresh and dry weight when contrasted with untreated control. Among the *Trichoderma* isolates, *Trichoderma harzianum* (Th8) was observed to be most potential and expanded seedling tallness (11.49cm) (12.10cm), fresh shoot weight (10.38g), dry shoot weight (1.20g), fresh root weight (1.43g) and dry root weight (0.31 g) and was at standard with University strain (*T. asperellum*). The enhancement was indicated by increased plants root growth and nutritional status (Harman *et al.*, 2000) [4] and induced systemic resistance to diseases (Harman *et al.*, 2004). Bae *et al.*, (2009) showed that cacao (*Theobroma cacao*)

seedlings which were colonized by *Trichoderma hamatum* isolate DIS 219b enhanced seedling growth and development. In addition to the biocontrol action, beneficial effects of *Trichoderma* on plants have been reported in terms of growth promotion and defense induction against biotic and abiotic stresses (Hermosa *et al.*, 2012; Rubio *et al.*, 2014). Trichoderma–colonized plant due to their action as plant growth regulators (auxin and/or auxin-like compound) (Vinale *et al.*, 2008).

Seed bio primed with *Trichoderma* isolates increased seedling height, shoot fresh and dry weight and root fresh and dry weight as compared to untreated control under pot condition in the green house.

Among the tested *Trichoderma* isolates, seed bio primed with Pusa strain *Trichoderma asperellum* obtained higher seedling height (12.10cm), fresh shoot weight (10.38g), dry shoot weight (1.20 g), fresh root weight (1.43g) and dry root weight (0.31 g) and was at par with Th-8 isolates.

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