Trichoderma sp.: A Source of Defense Related Enzyme

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Abstract:

Plants are known to respond to pathogen attack in various ways. As soon as the pathogen penetrates the host cell, a defense response cascade of the host cell operates and, as a result, different physical and chemical changes occur in the host cells. This hypersensitive response (HR) is characterized by strengthening of host cell walls due to the synthesis of wall bound phenolics, activation of cell death program and induction of a host of other biochemical responses which include accumulation of defense related proteins and antimicrobial compounds. All these responses, directly or indirectly, play a role in restricting the growth/entry of pathogen in the host.

In our result biocontrol treated seeds elicit induced resistance in tomato plants by induction of host defense related enzymes before inoculation with pathogen. However, there was a further increase in the enzymatic activity after challenged inoculation, indicating that increase enzymatic activity is a natural response of susceptible infected plants to pathogen attack. The enzymatic activities increased further 24-72 HAC and reduced slightly towards 72-96 HAC. Tr4-(*T. viride* + *T. virens*) + *Fusarium* sp. recorded maximum enzymatic activity followed by Tr2-*Trichoderma virens* + *Fusarium* sp. than Tr3-*Trichoderma viride* + *Fusarium* sp. after 48 HAC. Lower enzymatic activities were consistently detected in non-challenged control throughout the study and were lower than biocontrol treated seedlings.

Introduction:

Tomato (*Lycopersicon esculentum* L.) is a popular vegetable widely grown in the tropics which is an excellent source of vitamin A and vitamin C, minerals like iron and phosphorus. In tropical Asia it is an important cash crop from small farmers [1]. It tops the list of industrial crops because of its outstanding processing quantities. The crop is affected by several fungal pathogens, of which *Fusarium oxysporum* f sp. *lycopersici* inciting wilt disease is a major constraint in the production of tomato. *Fusarium* sp. is essentially soil borne [2, 3]. The wilt incidence was reported to an extent of 25 percent in various cultivars of tomato [4]. The most common method to check the disease is by using fungicides, but frequent and indiscriminate use of fungicide leads to atmospheric pollution and development of fungicide resistance in pathogens.

Trichoderma is reflected its worldwide distribution, under different environmental conditions, and its survival on various substrates. This considerable variation, coupled with their amenability of cultivation on inexpensive substrates, makes *Trichoderma* isolates attractive candidates for a variety of biological control applications [5]. *Trichoderma* strains are always associated with plant roots and root ecosystems. Some authors have defined *Trichoderma* strains as plant symbiont opportunistic avirulent organisms, able to colonize plant roots by mechanisms similar to those of mycorrhizal fungi and to produce compounds that stimulate growth and plant defense mechanisms [6].

Material and Methods:

Plants treatments for analysis of defense-related enzymes Phenylalanine Ammonia Lyase (PAL)

The study was carried out under green house conditions to determine the induction of defense related enzyme in Tomato plants. Seed dressing and fungal inoculums were prepared as mentioned previously. Seeds were treated with individual and combination of *T. virens and T. viride* isolates, sown in trays containing sterilized soil. After seed germination, seedlings were challenged inoculated by transferring to previously infested soil with *Fusarium oxysporum* as stated earlier. Control seedlings were treated with sterile distilled water. Transplants were planted at the rate of 20 transplants per root-trainer and three root-trainers per treatment were used. Sampling for induction of enzymatic activity was carried out at every 12 h after challenge inoculation of pathogen (HAC) for 96 h. four plant samples were collected from each replication of the treatment separately and used for analysis.

Experiment laid out in Randomized block designs with five treatments detailed below and were replicated thrice. The treatments were- Tr0- Control, Tr1- Control + *Fusarium* sp., Tr2- *Trichoderma virens* + *Fusarium* sp., Tr3- *Trichoderma viride* + *Fusarium* sp., Tr4- (*T. viride* + *T. virens*) + *Fusarium* sp.

Estimation of proteins by protein-dye binding method: The proteins were estimated by protein-dye binding method of Bradford [7].

Observations and Result:

The induction of resistance has now become another important mechanism against plant disease suppression by producing defense related enzymes. Seed treated with biocontrol agent results resistance in hosts offering a practical way of immunizing plants against pathogen ingress. The results presented here indicated that biocontrol treated seeds elicit induced resistance in tomato plants by induction of host defense related enzymes before inoculation with pathogen. However, there was a further increase in the enzymatic activity after challenged inoculation, indicating that increase enzymatic activity is a natural response of susceptible infected plants to pathogen attack.

The enzymatic activities increased further 24-72 HAC and reduced slightly towards 72-96 HAC. Tr4-(*T. viride* + *T. virens*) + *Fusarium* sp. recorded maximum enzymatic activity followed by Tr2-*Trichoderma virens* + *Fusarium* sp. than Tr3-*Trichoderma viride* + *Fusarium* sp. after 48 HAC. Lower enzymatic activities were consistently detected in non-challenged control throughout the study and were lower than biocontrol treated seedlings.

Conclusion:

Many studies have been done on different aspects of interactions between different bioagents. However, the beneficial effects of these bioagents on different plants and their applied mechanisms are varied. Therefore, more study is needed to illustrate different aspects of these interactions.

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