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Antagonistic properties of *Trichoderma viride* with special reference to vegetable plant diseases

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Abstract

Trichoderma viride is a fungus which is useful to control soil borne pathogens among these pathogen, *Fusarium oxysporum* and *Alternaria alternata* are considered as major pathogen of many economically important vegetable crops. It is isolated from infected vegetable plant material in December 2019. Generally farmers use disease resistant variety and chemical fungicide to control vegetable diseases which is harmful or insufficient, thus we use Bio control methods which is ecofriendly by using dual culture Method. In the present study *Trichoderma viride* use against *Fusarium oxysporum*, *Alternaria alternata* and *Colletotrichum capsici* inhibitions of mycelial growth of both the pathogens were observed. The highest inhibition showed against *Colletotrichum capsici* up to 89%, *Alternaria alternata* 73% and *Fusarium Oxysporum* 67% after 7 days of incubation. Standard fungicide (Hexaconazole 5ppm) is used to compare with the test isolates. *Trichoderma viride* revealed better result than fungicide.

Keywords: *Trichoderma viride*, *Colletotrichum capsici*, *Fusarium oxysporum*, *Alternaria alternata*, Dual culture method

Introduction

Vegetables are very important food in our daily diet it is very rich source of vitamins, minerals, fibers and nutrients which is reduce number of chronic diseases. Soil borne plant pathogens cause serious loss of vegetable crops in all over the world. India is the second most country to produce vegetables due to diverse climatic condition. Now day's agriculture has been facing number of problems of pest and pathogens. Which reduce huge amount of vegetable crop production quantitatively as well as qualitatively. Due to that farmers use high amount of chemical pesticide which is very harmful to the humans as well as animals even it can disturb soil biota and pollute the water reservoirs. Likewise, chemical pesticide may not be realistic nor economical for the control of many soil-borne pathogens. Therefore bio control approach offers an ecofriendly alternative to protect vegetable plants from these fungi. *Trichoderma* species is one of the most important biological control for possessing different mode of action against plant pathogens, as well as competition of nutrients, mycoparasitism and antibiosis by hydrolytic enzymes namely chitinases, β -glucanases and proteinases (Mendez-Vilas, 2010; Valencia *et al.*, 2011) [8, 15]. *Trichoderma* belongs to Ascomycetes mostly found in soil, on the surface of wood, other fungus and able to utilize various substrates demonstrating their adaptability to different ecological condition (Altomare *et al.* 1999) [1] some strains of *Trichoderma* species are long lasting colonization in root surface they are non-pathogenic to plants, and they produce wide range of antibiotic such as viridin, gliotoxin and antifungal secondary metabolites (Sivasithamparan and Ghisalberti) [14]. *Trichoderma* species are very popular for their capability to enhance plant growth up to 30% it can help to enhance root growth as well as plant productivity. *Trichoderma* species particularly *T. viride* and *T. harzianum* exhibit significant variation among strains with respect to their antagonistic activity and host range (Sivan and Chet, 1989) [13]. *Fusarium oxysporum* and *Alternaria alternata* are worldwide distributed, in India huge number of Agricultural crops especially vegetables are widely infected by these fungi. *Fusarium* yellows or wilts disease cause by these fungi in number of vegetables. *A. alternata* is a fungus which causes leaf spot disease more than 380 plant species and it also infect upper respiratory tract and Asthma in human. Fungicides are regularly recommended for plant disease control, but may negatively impact on the environment and non-target organisms (Brimner & Boland 2003) [2].

According to the Chet 1987^[3] Papavizas 1985^[11] *Trichoderma* species are active mycoparasites against a huge range of economically important aerial and soil-borne plant pathogens, and it is effectively used as a bio pesticide in greenhouse and Agricultural field.

Trichoderma viride have been most important to control soil borne pathogens as well as it maintain soil fertility and soil biota. So we used alternative way to ecofriendly management of vegetable plant diseases.

Material and Methods

1) Sample collection and Isolation of fungi

The infected vegetable plant materials (leaf and fruits) were collected from Belora district Jalna between October 2019 to December 2019. The collected plant material were wash with tap water followed by sterilize water then cut in to small pieces on the margin of healthy and diseased tissue after that surface sterilization is done with 4% HgCl₂ for 5 minutes then rinse with sterile distilled water, and inoculated on Potato Dextrose Agar plates. The Petri plates were incubated at 30⁰ ± 2⁰ C for 7 days. Pure culture of *trichoderma viride* was obtained from department of Microbiology, Institute of Science Aurangabad

2) Identification of vegetable plant pathogenic fungi

Isolated fungi were identified based on morphological and cultural characteristics by standard manuals, maintain pure culture and stored at 4⁰ C for further study. (Gilman and Guest)

3) Antagonistic activity of *Trichoderma viride*

Antagonistic activity of *Trichoderma viride* was tested against

the isolated pathogenic fungi by dual culture method (Morton and Stroube, 1955)^[9]. *Trichoderma viride* and test fungi were inoculated 5 mm mycelia on PDA plate by using cork borer. The mycelium of *Trichoderma viride* and pathogens were placed opposite side to each other on a PDA plates three replicates were maintained for each, treated plates incubated at 30 ± 2°C for 7 days. Pure culture plates of the pathogens used as control. Seven days after incubation, radial growth of test fungi and *Trichoderma viride* were measured. Colony diameter of test fungi in dual culture plate was observed and compared with control. The percent inhibition of mycelial growth over control was calculated by following formula.

$$I = \frac{(C-T)100}{C} \text{ (Vincent, 1947) }^{[16]}$$

Where,

I = Percentage of mycelial growth of inhibition

C = Mycelial growth in control.

T = Mycelial growth in treated.

4) Antagonistic activity of Hexaconazole:

The Antagonistic activity of the fungicide (Hexaconazole) was used to study the comparative account of the isolated pathogenic fungal inhibition by dual culture method with reference to the Antagonistic activity of the *Trichoderma viride* (Morton and Stroube, 1955)^[9].

Result and Discussion

Table 1: Growth of inhibition of isolated fungi against *Trichoderma viride* with control

Antagonistic fungi	Radial growth of <i>A. alternata</i> (mm)	% Inhibition	Radial growth of <i>F. oxysporum</i> (mm)	% Inhibition	Radial growth of <i>C. capsici</i> (mm)	% Inhibition
Control	90	00.00	90	00.00	90	00.00
<i>T. viride</i>	25	72.22	30	66.66	10	88.88
Hexaconazole	60	33.33	70	22.22	55	38.88

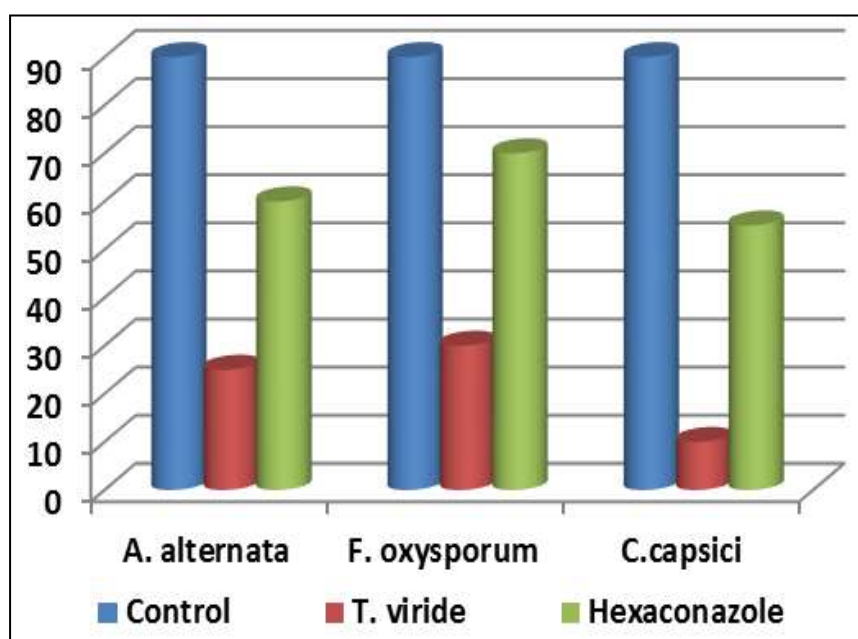
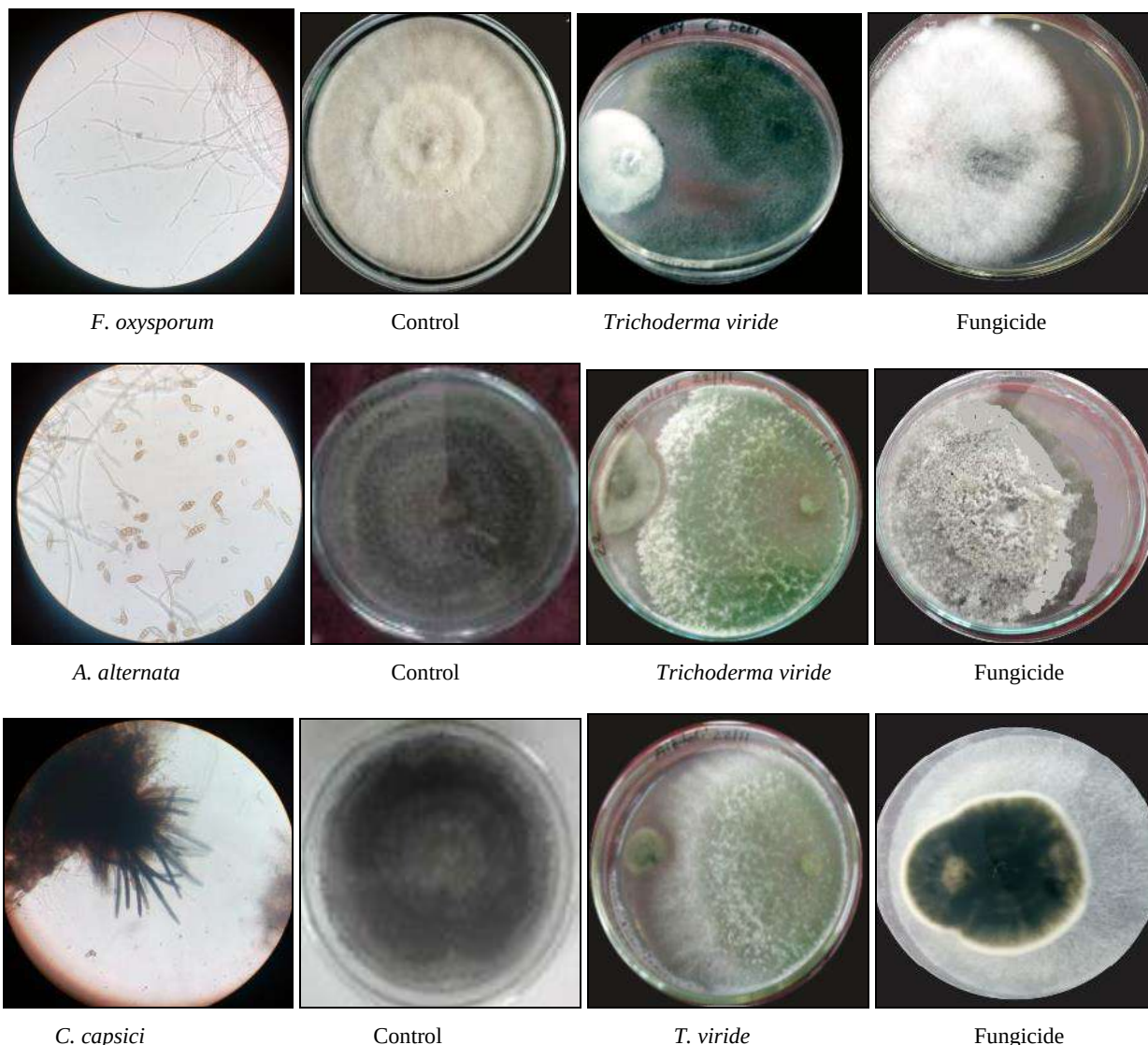


Plate 1: Antagonistic activity of *Trichoderma viride* against isolated fungi compared with Fungicide and control



C. capsici, *A. alternata* and *F. oxysporum* were isolated from the infected fruits such as chilli, cauliflower and tomato in the laboratory. Mostly *Trichoderma* species are used as biocontrol agent in various soil-borne pathogens (Ranasingh *et al.* 2006; Moubarak and Abdel-Monaim 2011) [12, 10] in the present work results revealed that in the Table 1 and plate 1 by dual culture methods maximum inhibition of *Trichoderma viride* were showed against *Colletotrichum capsici* (88.88%), *Alternaria alternata* (72.22%) and *Fusarium oxysporum* (66.66%) as compared to standard fungicide Hexaconazole (38.88%, 33.33% and 22.22%) respectively. According to Etbarian (2006) [4] *Trichoderma Viridae* reduced the colony area of *Macrophomina phaseoli* by 19.2 and 34.9% by using the dual culture method. *Trichoderma* spp revealed that (Tv-2) (71.41%) highly inhibited the mycelia growth of pathogen over control by dual culture method (Faheem *et al.*, 2010) [5]. *Trichoderma viride* recorded maximum inhibition of mycelial growth (86.2%) of test fungus inciting collar rot of groundnut followed by *T. harzianum* (80.4%) (Harsukh *et al.*, 2011) [7]. Importance of *Trichoderma* species were showed against *Fusarium oxysporum* sp. *Carthami* causing wilt of safflower and isolates no. 29 and 33 were found to reduce the growth of the pathogen as compared to others (Waghmare and Kurundkar, 2011) [17]. Plant growth hormones such as auxins production and phosphate solubilizing are significant in adaptable plant and root growth in different crops. IAA produced by *Trichoderma* species was found important for root growth and to increase seedling quality (Gravel *et al.*, 2007)

[6]. *Trichoderma* species are very important for the enhancement of production and quality of vegetable as well as all agricultural crops.

Conclusion

The present study reveals the important role of *Trichoderma viride* has a very effective antagonistic activity against *A. alternata*, *F. oxysporum* and *C. capsici* as compared to fungicide (Hexaconazole). Therefore, it could be strongly suggested the potential of *Trichoderma viride* used as a Bio-control agent for the management of vegetable plant diseases without effecting the environment serving to reduce soil salinity and increase the fertility.

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