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Bio-control of *Fusarium oxysporum* f. sp. *coriandrii*, causing coriander wilt by using *Trichoderma species*

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Abstract

The wilt of coriander caused by *Fusarium oxysporum* f. sp. *coriandrii* is one of the most serious disease which causes severe yield loss up to 80 to 90 percent under favourable conditions and the disease shows deadly symptoms. The samples of coriander showing wilt symptoms were collected from different districts of Maharashtra state. Antagonistic activity of *Trichoderma species* were examined by using dual culture technique on Czapek Dox Agar medium.

The fungal antagonists reduced mycelial growth of *Fusarium oxysporum* f. sp. *coriandrii*. It is clear that *Trichoderma sp*., has very great potential of antagonistic activity against *Fusarium oxysporum* f. sp. *coriandrii*. The *Trichoderma pseudokoningii* was gave maximum inhibition of both sensitive and resistant isolates of *Fusarium oxysporum* f. sp. *coriandrii*.

Keywords: Antagonistic, Coriander, *Fusarium*, *fungal*, *Trichoderma*

Introduction

Coriander (*Coriandrum sativum* Linn.) is one of the first species to be consumed by human beings as a common flavouring substance. The entire plant is edible, but the fresh leaves and the dried seeds are the most traditionally used in cooking

As per Brown and Hall (1979) [2], pleasant aromatic odour is present in the leaves and fruit of the coriander, which is due to an essential oil containing linalol or coriandrol. As per findings of Brown and Hall (1979) [2], beside essential oil seed contain 20-23 percent fatty oil which is used in the cosmetic industries and leaves contain 87.9 percent moisture, 3.3 percent protein, 0.6 percent fat, 6.5 percent carbohydrates, 21.7 percent protein mineral matter. According to Emenky *et al.* (2008) [6], coriander is the richest source of proteins, essential oils and aroma.

The seeds are also considered to be carminative, diuretic stomatic, tonic anti-bilious, refrigerant and aphrodisiac (Duke, 1981; Huisman and Van der Poel, 1994) [5]. Therefore, coriander is used in many ayurevedic medicines as an ingredient.

Such nutritionally, medicinally and commercially important crop is affected by various serious diseases and leads to heavy destruction.

According to Nene *et al.* (1996) [8] coriander is attacked by about 63 fungi, 5 bacteria, 20 viruses, and 70 nematodes. The major fungal diseases are wilt, powdery mildew, leaf spot, stem blight, and root rot etc.

Among these, wilt of coriander caused by *Fusarium oxysporum* f. sp. *coriandrii* is very serious disease in India. According to Tewari and Mukhopadhyay (2001) [11] wilt of coriander caused by *Fusarium oxysporum* f. sp. *coriandrii* is one of the most serious disease which causes severe yield loss up to 80 to 90 percent under favourable conditions and the disease shows deadly symptoms.

Fusarium oxysporum f. sp. *coriandrii*, having worldwide distribution. It is well known pathogen causing wilt disease in temperate, tropical regions with high severity and it belongs to class Deuteromycetes. (Subramanian, 1971; Barnett and Hunter, 1972) [10, 1].

Materials and Methods

Collection of Samples

During present investigation, samples of coriander showing wilt symptoms were collected from different districts of Maharashtra state and brought to the laboratory in sterile

polythene bags. Fifteen isolates of *Fusarium oxysporum* f. sp. *coriandrii*, were obtained from collected samples and maintained on Czapek Dox Agar medium at 5 ºC.

Dual Cultural Methods

Antagonistic acivity of *Trichoderma spp.*, i.e *Trichoderma viride.*, *Trichoderma harzianum*, *Trichoderma virens*. and *Trichoderma pseudokoningii*, were examined by using dual culture technique on Czapek Dox Agar medium. 20 ml Czapek Dox Agar medium was poured in to sterilized petriplates. 8 mm disc of actively growing mycelium was aseptically picked from 8 day old culture of *Trichoderma spp.* and *Fusarium oxysporum* f. sp. *coriandrii*, were placed on opposite side of the plate (equal distance from periphery). Triplicates of both sensitive to benomyl Fo-3 and resistant to benomyl Fo-13 isolates were maintained and incubated at 28 ± 2 ºC. For control plates at the opposite side of sensitive and resistant isolates of *Fusarium oxysporum* f. sp. *coriandrii*, 8mm sterile agar disc were placed and radial mycelial growth was measured at specific time intervals up to 8 days. In each treatment inhibition of linear mycelial growth were recorded and calculated by using formula (Lokesh and Benagi, 2006) [7].

Inhibition percent of mycelial growth = (C-T/C) × 100

Where as,
C = Radial mycelial growth in mm of *Fusarium oxysporum* f. sp. *coriandrii* in control plates.
T = Radial mycelial growth in mm of *Fusarium oxysporum* f. sp. *coriandrii* in treated plates.

Mycelial fragments from interaction region between *Fusarium oxysporum* f. sp. *coriandrii* and *Trichoderma* spp., were picked with the help of sterile forcep, stained with lactophenol cotton blue and observed under microscope.

Results

The antagonistic property of *Trichoderma species* against *Fusarium oxysporum* f. sp. *coriandrii* as a biocontrol agent showed a very favorable result. The fungal antagonists reduced mycelial growth of *Fusarium oxysporum* f. sp. *coriandrii* (Table 1). It is clear that *Trichoderma sp.*, has very great potential of antagonistic activity against *Fusarium oxysporum* f. sp. *coriandrii*. The *Trichoderma pseudokoningii* was gave maximum inhibition of both sensitive and resistant isolates of *oxysporum* f. sp. *coriandrii* (Table 1, Fig. 1 and Plate No. 1).
The results strongly indicates mycoparasitism. Coil formation is a common symptom of mycoparasitism and leads to the death of *Fusarium oxysporum* f. sp. *coriandrii*.

Discussion

Wilt caused by *Fusarium oxysporum* f. sp. *coriandrii* is one of the major problem in the yield of Coriander throughout the India. The pathogen is soil borne and hence many practices especially the use of chemicals in controlling the spread of wilt is less effective. Many chemical practices help to spread of the disease. Chemical practices involve use of various systemic and contact fungicides (Desai and Kamble, 2017) [4]. But, unselective uses of fungicides of all kind including systemic, contact, etc. are not only harmful to environment but also show severe effect to human being and animals. Therefore, using certain bio – control agents is one of best alternative against the use of chemicals for the soil borne fungal pathogen like *Fusarium oxysporum* f. sp. *coriandrii*.

Table 1: Antagonistic activity of *Trichoderma sp.* against sensitive and resistant isolates of *Fusarium oxysporum* f. sp. *coriandrii*.

Sr. No.	Antagonist	Percentage (%) inhibition of mycelial growth	
		Sensitive Fo 3	Resistant Fo 13
1	*Trichoderma virens*	73.20	78.88
2	*Trichoderma viride*	69.81	69.71
3	*Trichoderma harzianum*	58.88	72.09
4	*Trichoderma pseudokoningii*	74.36	76.69

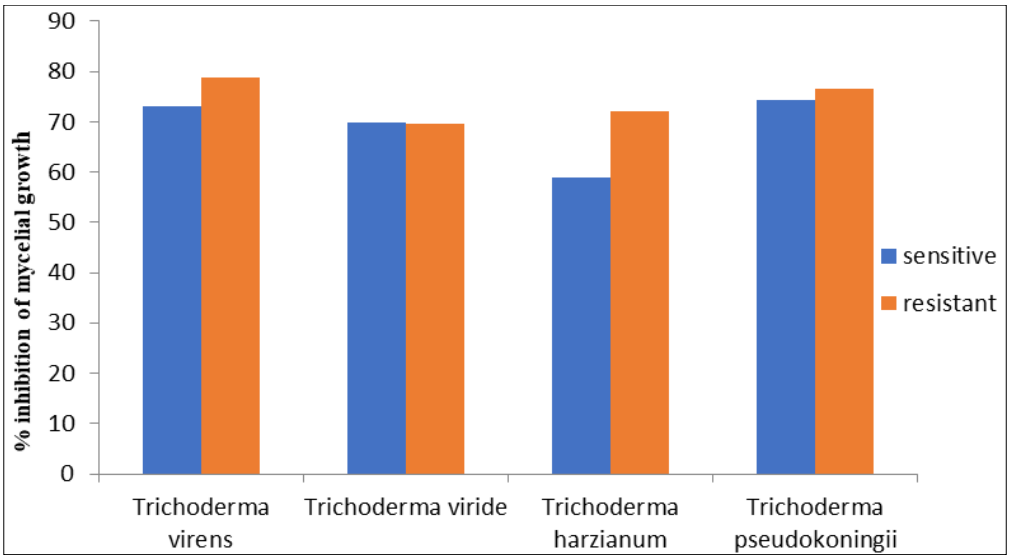

Fig 1: *In vitro* inhibition of growth of *Fusarium oxysporum* f. sp. *coriandrii* by *Trichoderma sp.*, in dual culture method.

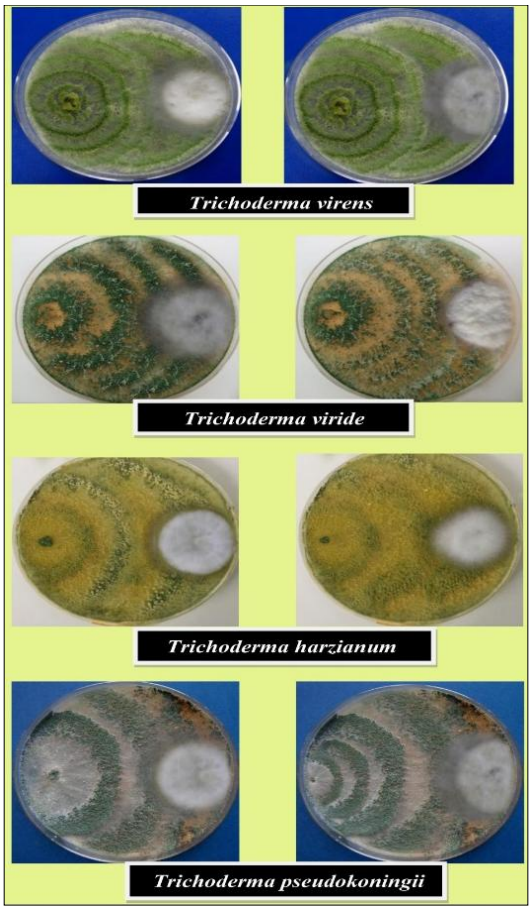

Plate 1: Biocontrol of *Fusarium oxysporum* f. sp. *coriandrii* by using Trichoderma Spp.

Conclusion

The *Trichoderma pseudokoningii*, gave maximum inhibition of both sensitive and resistant isolates of *Fusarium oxysporum* f. sp. *coriandrii*, followed by *Trichoderma virens* and *Trichoderma viride*. The advantages of use of bio-control includes eco-friendly, cost effective and give best results.

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