Inhibitoy effect of various antagonist against Fusarium wilt of stem, and root rot caused by *Fusarium oxysporum*

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ABSTRACT

With these views, the studies were initiated to assess the efficiency of different antagonists against important plant pathogen causing damage to various plants. The ten (10) antagonists i.e. Aspergillus niger, Aspergillus fumigatus, *Aspergillus flavus, Trichoderma viride, Trichoderma fuscum, Trichoderma harzianum, Trichoderma atrovride*, Penicillium oxalicum, *Trichoderma sp., Verticillium lecanae were tested; Antagonists were isolated from vegetable rhizosphere the observation of different antagonists is narrated. The inhibitory effect of various antagonists against Fusarium oxysporum, These plant pathogens causing root, stem, leaf*, fruit, etc. diseases to various vegetable plant and many other economically important plants.

Key Word :- *Biological control , Fungi, Antagonists, Fusarium oxysporum*

Inroducion :- The interaction of one organism with another organism is called as antagonistic effect; it is naturally occurring processes of the ecosystems. It includes environment, loss of organic matter and development of resistance. Antagonistic management is the reduction of inoculums density of diseases producing activities of the pathogen by one or more organisms reduced. Antagonistic microorganism, it helps protection of vegetable crop, as well as increase yield of crop. Biological control through introduction of antagonists to the soil for reduction of insect pest and diseases was also experimented. Biocontrol is modern techniques in agriculture sector; it does not have side effect and it is ecofriendly technique it not produces any hazardous material. It is eco-friendly managements of pathogenic microorganism. The antagonistic fungi it has a potential to restrict other fungi and arrest of pathogen achieved by way of antibiosis.

Specific bacterial and fungal antagonists of the rhizosphere can induce this systemic effect in plants (Btissam *et al.,* 2015). There is little investment in the research development of fungal biological control agents compared with that spent on the discovery of chemical pesticides. Two reasons for this is the mycoparasites usually have narrow host range and because they have given inconsistent or poor control in field trials. This has led to a greater emphasis on the search for broader spectrum bio pesticides with improvements in the associated production, formulation and application technologies.

Among the antagonists, *Trichoderma spp.* was the mostly selected as a unique biocontrol agent to control the most of the soil borne plant pathogens. Some other fungi reported to minimize the fungal diseases in vegetable crops are *Thlebiopsis gigantean, Gliocladium catenulatam, Cryptococus albidus, Coniothyriym minitans* and *Fusarium oxysporum.* Fungal antagonist *Trichoderma* was evaluated as potential bio-control agent against number of fungal phytopathogens. Species of the genus *Trichoderma* are well-documented fungal biocontrol agents (Zahra Ibrahim El-Gali, 2015). The fungi *Trichoderma spp.* is one of the most important bio-control agents and most frequently isolated from soil and plant root ecosystems (Harman, *et al.,* 2004). Several strains of *Trichoderma* have been develop as biocontrol agents against fungal diseases of plants (Harman, 2006). *Trichoderma* is a biological microorganism for controlling the soil borne plant pathogens has been considered a more natural and environmentally

acceptable alternative to the existing chemical treatment methods (Baker, *et al.,* 1996]. The antagonistic activity of *Trichoderma* species against plant pathogen has been studied extensively (Hjelijord, *et al*., 2001). *Trichoderma* produces some antibiotics, which penetrate in to pathogen and thereby inhibit the growth of the pathogenic fungi. Antagonistic microorganisms have been used successfully to control gray mold, including fungi (Yohalem and Kristensen, 2004; Btissam Mouri *et al*., 2015). The specific bacterial and fungal antagonists of the rhizosphere can induce in this systemic effect in plants ensures as well telluric that leaf disease control (Btissam Mouri *et al*., 2015). The various isolated antagonistic fungi were used for management of different vegetable diseases. Many farmers' uses as chemical fungicides against fungal pathogen therefore, the present studies were initiates to assess the antagonistic proprieties of many rhizosphere fungi against the soil born fungi of vegetable crops i.e. brinjal, chili, okra and tomato.

Materials and method:-

Collection of different antagonists :- Different antagonists were collected and isolated from soil samples of four *vegetable* crops. Antagonistic fungi were isolated by serial dilution agar plating method. Rhizosphere fungi were used for antagonistic analysis. The ten fungi selected for evaluation of its antagonistic properties were- *Aspergillus niger, Aspergillus fumigates, Aspergillus flavus, Trichoderma viride, Trichoderma fuscum, Trichoderma harzianum, Trichoderma atroviride, Penicillium oxalicum, Trichoderma sp., Verticillium lecanae*. All these antagonists were isolated fromr rhizosphere soil samples of vegetable fields.

Collection and isolation of fungal pathogens :- In the present investigation, foliar pathogenic fungi of vegetables were selected for antagonistic analysis, viz. *Fusarium oxysporum*

Selection and preparation of media :- For isolation and maintenance of fungal pathogens of vegetable plants potato dextrose agar (PDA) medium were selected.

Antagonistic analysis :- To see the antagonism against different pathogens dual culture method was adopted. Autoclaved medium was poured into the glass petriplate and was allowed to solidify. The 5 mm discs of antagonist from the stored culture were cut using a sterile cork borer under aseptic conditions. In the petri, plate of solidified medium a disc of pathogen kept in the center and three discs of antagonistic fungi were placed at equidistant from the center. Control plate containing only pathogen was also maintained. The radial mycelial growth of pathogen and antagonists were measured for every 24 hours up to seven days and inhibition per cent was calculated on 3rd, 5th and 7th day. The per cent inhibition by antagonistic fungi was calculated using the following formula.

$$\text{Per cent inhibition} = \frac{T\,FC - T\,FTr}{T\,FC} \times 100$$

T F C- Test fungus in control

T F Tr- Test fungus in treatment.

Result and Conclusion:- The present day need is to develop and utilize the effective low cost eco-friendly technologies in the crop production program. Accumulation of unwanted chemical applied which directly influencing the ecological natural systems. With these views, the studies were initiated to assess the efficiency of different antagonists against important plant pathogen causing damage to various plants. The ten (10) antagonists i.e. *Aspergillus niger, Aspergillus fumigatus, Aspergillus flavus, Trichoderma viride, Trichoderma fuscum, Trichoderma harzianum, Trichoderma atrovride, Penicillium oxalicum, Trichoderma sp., Verticillium lecanae* were tested. Antagonists were isolated from vegetable rhizosphere the observation of different antagonists is narrated. The inhibitory effect of various antagonists against *Fusarium oxysporum*, were evaluated in *vitro*;.These plant pathogens causing root, stem, leaf, fruit, etc. diseases to various vegetable plant and many other economically important plants.

Inhibitory effect of various antagonist against *Fusarium oxysporum.*

Fusarium oxysporum causing wilting diseases of vegetable such as brinjal, chili, okra and tomato, the antagonistic effect of different fungi was assessed against *Fusarium oxysporum* observation are recorded in Table - 1 (Fig. 1 and Plate1). Radial mycelial growth was measured on the 3rd, 5th and 7th day of incubation. Radial mycelial growth of *Fusarium oxysporum* was also recorded in control. However, the maximum inhibition was recorded in *Trichoderma fuscum* (82.35), *Trichoderma sp.*(82.35),where as the minimum growth in *Penicillium oxalicum, (35.29%) at 3rd day of incubation.* However, the more inhibition was recorded in *Trichoderma fuscum* (83.33) and less inhibition (27.77) was observed in *Penicillium oxalicum* on 5th day.100% per cent inhibition was observed in *Trichoderma fuscum, Trichoderma harzianum, Trichoderma atrovride, Trichoderma sp.,Verticillium lecanae, Aspergillus fumigatus*on 7th day and less in *Penicillium oxalicum* (*23.52%).*

Table 1:- Effect of different antagonists on radial mycelial growth of *Fusarium oxysporum.*

Sr. No.	Antagonistic fungi	Radial mycelial growth (mm)*			% growth inhibition		
		3DAI	5DAI	7DAI	3DAI	5DAI	7DAI
1	*Aspergillus niger*	22.00	52.00	25.00	35.29	27.77	70.58
2	*Aspergillus fumigatus*	08.00	32.00	00.00	76.07	55.55	100.00
3	*Aspergillus flavus*	14.00	22.00	04.00	58.82	69.44	95.19
4	*Trichoderma viride*	16.00	28.00	01.00	52.94	61.11	98.82
5	*Trichoderma fuscum*	06.00	12.00	00.00	82.35	83.33	100.00
6	*Trichoderma harzianum*	08.00	16.00	00.00	76.47	77.77	100.00
7	*Trichoderma atroviride*	30.00	52.00	00.00	11.76	27.77	100.00
8	*Penicillium oxalicum*	22.00	52.00	65.00	35.29	27.77	23.52
9	*Trichoderma sp.*	06.00	30.00	00.00	82.35	58.33	100.00
10	*Verticillium lecanae*	18.00	20.00	00.00	47.05	72.22	100.00
11	Control	34.00	72.00	85.00	-	-	-

DAI = Day after Incubation, *Mean of three replicates.

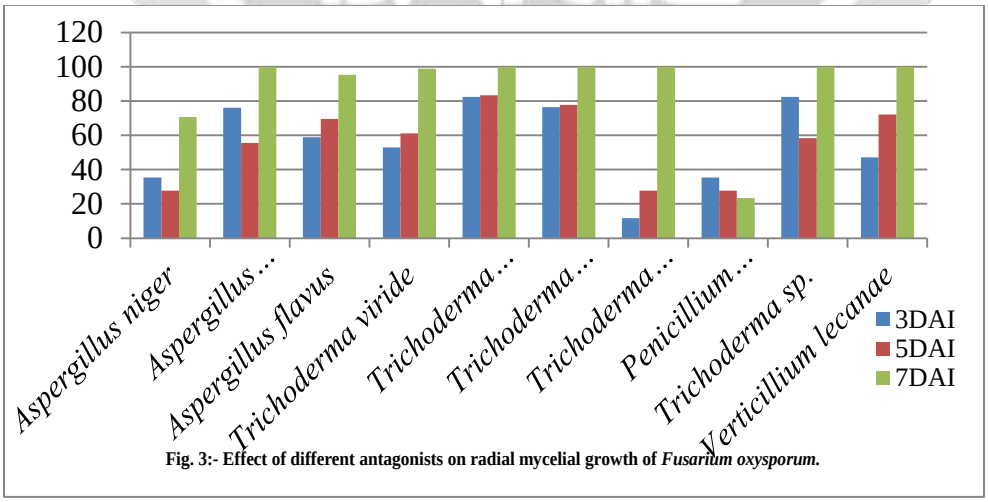

Fig. 3:- Effect of different antagonists on radial mycelial growth of *Fusarium oxysporum.*

Discussion: - Antagonistic study is eco-friendly management of fungal pathogen in soil rhizosphere. It is low cost and highly effective management technique. In nature microorganism interact as a consequence of their growth and development. The microbial antagonism observed in biological control of pathogens is broadly based potential of various antagonists was assessed in the present investigation. Biological control of plant pathogen is becoming an important component of the plant diseases management. More attention is diverted toward the use of *Trichoderma* against soil borne diseases which caused severe losses. Most of the diseases effectively management by *Trichoderma* as seed dresser as soil treatment or by using foliar sprays also. It is well documented that the *Trichoderma spp.* had varied ability to restrict growth of the pathogens. Resident antagonists are more virulent and adoptable to the natural situations (Kanherkar, 2005).
In the present investigation, 10 antagonistic fungi were undertaken viz. *Aspergillus niger, Aspergillus fumigatus, Aspergillus flavus, Penicillium oxalicum, Trichoderma viride, Trichoderma fuscum, Trichoderma harzianum, Trichoderma atroviride, Trichoderma sp.*and *Verticillium lecanae.* These antagonists were isolated from rhizosphere field offour vegetables and antagonists were mass multiplied on PDA medium for further studies. A variety of microbial antagonists have been reported to control several different pathogens of various fruits and vegetables (Fravel, 2005). Microorganisms used as biological control agents include *Trichoderma harzianum* against soilborne pathogens.

Conclusion:- From the observations and results it was calculated that among all antagonists tested for its antagonistic efficiency against the pathogenic fungi of vegetables, it was found that the various species of ubiquitous soil fungi *Trichoderma* such as *Trichoderma viride, Trichoderma fuscum, Trichoderma harzianum, Trichoderma atrovride* and *Trichoderma sp.* reported effective against pathogens from 3rd day of incubation. *Trichoderma harzianum* and *Trichoderma viride* found to be highly effective in controlling the radial mycelial growth of pathogen since 3rd day of incubation in dual culture technique. Among various species of *Trichoderma, Trichoderma fuscum, Trichoderma atrovride* and *Trichoderma sp.* found to be less effective as compared to efficient antagonists *Trichoderma harzianum* and *Trichoderma viride.* The few species of *Aspergillus* such as *Aspergillus niger, Aspergillus fumigatus, Aspergillus flavus* which have been tested shows less antagonistic efficiency as compare to *Trichoderma.* The present antagonistic analysis study clearly indicates that *Penicillium oxalicum* found to be the less effective as it fails to inhibits the radial mycelial growth of pathogen as compared to all tested antagonists. Maximum mycelial growth of pathogen was recorded in control, in which only pathogen was incubated.

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