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EVALUATION OF DIFFERENT FUNGAL ANTAGONISTS, PLANT EXTRACTS AND OIL CAKES AGAINST *FUSARIUM OXYSPORUM* F.SP. *CUMINI* CAUSING WILT OF CUMIN. (*CUMINUM CYMINUM* L.)

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***Trichoderma viride, T. harzianum, T. virens* and *T. hamatum* isolated from rhizosphere of cumin significantly inhibited the mycelial growth of *Fusarium oxysporum* f.sp. *cumini*. Maximum inhibition of mycelial growth (77.77% and 75.55%) was recorded with local isolates of *T. virens* and *T. viride* respectively. Coiling of antagonists hyphae around the pathogen hyphae and finally lysis were observed. Out of five plant extracts and four oil cakes, plant extract of *Datura stramonium, Calotropis procera* and oil cakes of mustard and *Sesamum*, inhibited mycelial growth at the maximum in *in vitro* condition.**

Key words : *Botanicals, cumin;* Fusarium oxysporum *f.sp.* cumini, Trichoderma harzianum, Trichoderma viride, Trichoderma hamatum, Trichoderma virens.

Cumin (*Cuminum cyminum* L.) is an important spice crop of Rajasthan. Wilt of cumin induced by *Fusarium oxysporum* f.sp. *cumini* is emerging as severe and destructive problem under favourable weather conditions during winter. The losses due to this disease is usually 5 to 80% (Mathur and Prasad, 1964a). Infection at seedling stage results in complete loss and in later infection either no seed is formed or it is thin, tiny and shrivelled. Reduction or elimination of soil borne inoculum is the only effective solution to overcome the problem and this may be achieved easily through fungal antagonists and soil amendments. Therefore studies were conducted to determine most effective fungal antagonists and soil amendments for further integration in the management practices of the disease.

MATERIALS AND METHODS

Leaf extracts of *Phyllanthus amarus, Calotropis procera, Ricuinus communis, Datura stramonium, Verbesena enceloides* were tested for their fungicidal efficacy by the poisoned food technique (Nene and Thapliyal, 1993). The extraction from plant parts was done with the help of pestle and mortar. By adding equal amount of hot water, the extracted material was then filtered through muslin cloth, further 6ml of extract was mixed with 100 ml of molten PDA cooled to 45°C @1% (w/v) and sterilized in autoclave. Each treatment was replicated thrice with appropriate untreated controls. These were incubated for 3 days at 28±1°C before recording radial mycelial growth of *Fusarium oxysporum* f. sp. *cumini*.

To determine the most effective soil amendment four oil cakes *viz., Azadirachta indica, Gossypium* sp., *Sesamum indicum* and *Brassica campestris* were evaluated against pathogen in *in vitro*. Fine powdered oil cakes soaked in sterile water @ 1g/ml mixed in mixer and filtered (100% solution). Six ml of this solution was incorporated into 100ml PDA under sterilized condition in three replications. The radial growth of mycelium was recorded for each replication, separately.

RESULTS AND DISCUSSION

Effect of Antagonists : The results presented in Table-1 revealed that the isolate of *Trichoderma virens* and *Trichoderma viride* were the most effective in which maximum growth inhibition of mycelium of *Fusarium oxysporum* f.sp. *cumini* was recorded i.e. 77.7% and 75.55%. Next to it were isolates of *T. hamatum* and *T. harzianum* with their respective growth inhibition of 69.77% and 62.22%. *Trichoderma virens* grew over the colony of *Fusarium oxysporum* f.sp. *cumini* after 3-

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4 days of incubation. This overgrowth may be due to its fast growing nature, rapid sporulation, secretion of gliotoxin and / or cell wall lytic enzymes in dual culture. Thus it acts both as a competitor and antagonist. It is known to produce many enzymes i.e. chitinase, endochitinase, b1, 3 glucanase and secondary metabolites which possibly would have been involved in antagonism. *T. virens* covered the entire petriplate suppressing the growth of the pathogen. *Fusarium* could not be reisolated from this place, strongly suggesting suppression of the pathogen in dual culture. In case of other *Trichoderma* spp. host fungi initially grew towards the biocontrol agent, however the growing edge of *Fusarium* ceased before it could make contact with growing colony of *Trichoderma*. Later antagonist gradually overgrew the colony of *Fusarium* and inhibited the growth. Interaction with *Trichoderma harzianum* showed visible inhibition zone (2mm) while with *T. viride*,

Table-1 : Antagonistic effect of different fungi against *Fusarium oxysporum* f.sp. *cumini*

S. No	Test Mycoflora	Colony growth (mm) of *Fusarium oxysporum* f.sp. *cumini*		Growth inhibition of *Fusarium oxysporum* f.sp. *cumini* (%)
		Control (mm)	Interaction (mm)	
1.	*Trichoderma harzianum*	45	17	62.22
2.	*Trichoderma viride*	45	11	75.55
3.	*Trichoderma virens*	45	10	77.77
4.	*Trichoderma hamatum*	45	13.6	69.77

Values are mean of 3 replicates

there was distinct change in colour at the zone of contact which become light yellowish. *T. hamatum* did not produce any demarcation zone. The growth inhibition of *Fusarium oxysporum* in presence of *Trichoderma* spp. could be attributed mainly due to antibiosis or hyperparasitism. Some substances were released by them like non-volatile sesquiterpene antibiotic. Hyphae of species of *Trichoderma* over powered the growth of pathogen and entered inside the mycelium of the pathogen. Sometimes the mycelium of pathogen was also found to be full of antagonist spores. Ultimately, host hyphae shrivelled and got killed. These observations indicated that pathogen lost their viability after colonization with antagonists (Elad *et al.*, 1990; Gokulapalan *et al.*, 1984; Lewis and Papavizas, 1980; Liu and Baker, 1980).

Effect of plant extracts : According to the results (table-2) plant leaf extracts of *Datura stramonium* and *Calotropis procera* were found to be highly significant in reducing the radial growth of the pathogen (72.92% and 68.75%) respectively. The other extracts in order of superiority were *Ricinus communis*, *Phyllanthus amarus* and *Verbesena enceloides*. The inhibitory effect of the plant extracts might be attributed to the presence of some antifungal toxicants. The aqueous extracts of these plants were found to affect the growth of the fungus.

It is therefore, encouraging to identify and characterize the active principle. Moreover, because of the water soluble nature of the toxic principle, it is ideal for developing into herbal pesticide. The presence of antifungal compounds in higher plants is well recognised (Mahadevan, 1982) and considered

Table-2 : Effect of plant extracts on radial growth of *Fusarium oxysporum* f.sp. *cumini*

S.No.	Plant extracts	Colony growth (mm) of *Fusaruim oxysporum* f.sp. *cumini*		Growth inhibition of *Fusarium oxysporum* f.sp. *cumini* (%)
		Control (mm)	Interaction (mm)	
1.	*Phyllanthus amarus* Hutch.	80	26.66	66.67
2.	*Calotropis procera* (Ait) R.Br.	80	25	68.75
3.	*Ricinus communis* Linn.	80	25.33	68.33
4.	*Datura stramonium* Linn.	80	21.66	72.92
5.	*Verbesena enceloides* Benth & Hook.	80	35	56.25

Values are mean of 3 replicates

valuable for plant disease control (Singh and Dwivedi, 1987). Various plant extracts have been evaluated for their antifungal property against different pathogens (Tripathi *et al.*, 2002; Sinha *et al.*, 2002; Mathur and Gurjar, 2002).

Effect of oil cakes : The results (Table 3) revealed that *Brassica campestris* oil cake inhibited the radial growth of the pathogen (73.07%) at the maximum followed by *Sesamum* oil cake (67.94%). Efficacy of different oil cakes was tested by many workers (Rajan,

1980; Rajan and Menon, 1970 and Ratnoo and Bhatnagar, 1983) in respect of reducing the propagules of the pathogen. The reduction in radial growth of the pathogen may be due to the presence of some inhibitory and antifungal substances.

It can be concluded from the present study that fungal antagonists *viz. Trichoderma virens* and *Trichoderma viride*, plant extracts of *Datura stramonium* and *Calotropis procera* and oil cakes of *Brassica* and *Sesamum* can be used in integrated management of *Fusarium oxysporum* f.sp. *cumini* infecting cumin plant at economical level in ecofriendly manner.

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Table-3 : Efficacy of oil cakes against *Fusarium oxysporum* f.sp. *cumini*

S. No.	Oil cakes	Colony growth (mm) of *Fusarium oxysporum* f.sp. *cumini*		Growth inhibition of *Fusarium oxysporum* f.sp. *cumini* (%)
		Control (mm)	Interaction (mm)	
1.	Sesamum cake (*Sesamum indicum*)	78	25	67.94
2.	Mustard cake (*Brassica compestris*)	78	21	73.07
3.	Cotton cake (*Gossypium* sp.)	78	30.33	61.11
4.	Neem cake (*Azadirachta indica*)	78	26.33	66.24

Values are mean of 3 replicates

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