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COMPETITIVE SAPROPHYTIC ABILITY OF THE SORGHUM STALK ROT PATHOGENS IN FUNGICIDE AMENDED SOILS

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ABSTRACT

The competitive saprophytic ability (CSA) of the four sorghum stalk rot pathogens was estimated. Presence of fungicides in the soil as residues showed a profound effect in reducing their CSA. Aureofungin has drastically reduced the CSA of all the stalk rot pathogens while carbendazim, quintazene and chloronab had severe effect. Methoxy ethyl mercuric chloride had the least effect.

ज्वार के चार वृत विगलत रोगजनकों की प्रतिस्पर्धा मृत जीवी योग्यताओं का आंकलन किया गया। भूमि में कवकनाशियों के अवशेषों की उपस्थिती से इस योग्यता में अधिक कमी आयी। सभी रोगकारकों की यह योग्यता आरयोफंजिन से शीध्र घटी जबकि कार्बोडिजिम, क्वींटाजिन एवं क्लोरोनेब का गंभीर प्रभाव पाया गया। मिथाईल ऐथिल मरक्युरिक क्लोराइड का न्यूनतम प्रभाव रहा।

Root and stalk rot of sorghum (*Sorghum bicolor* (L.) Monech) is a complex disease caused by *Macrophomina phaseolina* (Tassi) Goid., *Fusarium moniliforme* Sheld., *F. moniliforme* var. *subglutinans* Rein. & Wollen and *F. semitectum* Berk. and Rav. (Pande and Karunakar, 1992). Cherkauskas *et al.* (1982) observed that fungicides and herbicides residues in soil significantly reduce the CSA of *M. phaseolina*. In the present investigation, the effect of commonly used fungicides on the CSA of the stalk rot pathogens was assessed by Cambridge method (Butler, 1953).

MATERIALS AND METHODS -

To estimate the effect of fungicides on the CSA of the stalk rot pathogens, a split plot experiment was designed with *M. phaseolina*. *F. moniliforme* var. *subglutinans*. *F. moniliforme* and *F. semitectum* as the main plot, 6 fungicides as the subplot with 4 replications. The inoculum of these pathogens was multiplied on sorghum meal - sand culture medium and incubated at 25 ± 2° C for 15 days.

The following six fungicides were employed : methoxy ethyl mercuric chloride (MEMC). aureofungin,

carbendazim, chloronab, quintazene and carboxin.

Soil from sorghum fields was mixed with sand culture inoculum at 20 : 80 ratio (v/v) and 1000 ppm active ingredient of the above fungicides was thoroughly mixed. No fungicide was added to the control treatment. The soil was filled in polythelene bags. Fifty sterilized sorghum stem pieces (2m length), were buried and incubated at 25 $\pm$ 2° C for 14 days. Soil moisture was maintained at 40% moisture holding capacity. After incubation, the stem pieces were retrieved from the soil, surface sterilized in mercuric chloride (0.1%) and plated on modified Czapek dox agar in petridishes. After incubating at 25 $\pm$ 2° C for 7 days, the number of stem pieces colonized by the test fungi were counted and percentage colonization was calculated. Mean percentage colonization was separated using Waller - Duncean Beyesian *k*-ratio LSD rule. Statistical analysis was done using GENSTAT computer program to calculate the analysis of variance among various treatments.

RESULTS AND DISCUSSION - Fusarial pathogens attained C_{50} value at 20% inoculum level, while the same amount of the inoculum load could not make *M. phaseolina* to colonize more than 48% of the stem pieces (Table 1). These results indicate high competitive saprophytic ability of *F. moniliforme* var. *subglutinans*, *F. moniliforme*, and *F. semitectum* and also low CSA of *M. phaseolina*. Botkan *et al.* (1979) reported that *F. moniliforme* var. *subglutinans* could colonize pineapple, soybean and corn stem pieces at a very low concentration exhibiting higher CSA. Rao (1959); Meyer *et al.* (1973); and Dhingra *et al.* (1976) reported that *M. phaseolina* possessed moderate competitive saprophytic ability.

All the fungicides significantly reduced the CSA of all the stalk rot pathogens as shown by Waller-Duncan's groupings. Aureofungin was the most effective in reducing CSA of all the stalk rot pathogens (Table 1). Chloronab and carboxin have also significantly reduced the CSA. Reaction of individual fungicides against each of the pathogens also varied significantly. Chloronab and quintazene have been highly effective in reducing the colonization of *M. phaseolina* by 67.3% and 50.2%, respectively. Aureofungin has caused 77.4% reduction in *F. moniliforme* while carboxin and chloronab also caused significant reduction. The CSA of *F. moniliforme* var. *subglutinans* was severely reduced by 70% and 68.7% by carbendazim and aureofungin, respectively. MEMC caused 67.3% reduction in the CSA of *F. semitectum*.

Ilyas *et al.* (1976) have observed that CSA of *M. phaseolina* was drastically reduced by the presence of fungicides in the soil in the form of soil residues. Kanniayan and Prasad (1986) reported that chloronab, carboxin and quintazene reduced the CSA and survival of *Rhizoctonia solani* in the soil. Quintazene, carboxin and thiram reduced the population of *M. phaseolina* in the soil (Anahosur *et al.*, 1983). Taneja and Grover (1982) have reported that 5 benzimidazole derived fungicides to be very toxic to *R. solani* and *M. phaseolina* in the soil. Herbicides (paraqut) and pesticides were also reported to have reduced the CSA of *M. phaseolina* in the soil (Cherkauskas *et al.*, 1982). Maffia

Table 1. Effect of different fungicides on the competitive saprophytic ability of sorghum stalk rot pathogens

Fungicides	(% colonization)				
	MP	FM	FMS	FS	Mean
MEMC	38.2 b	55.2 b	42.7 c	20.0 e	39.1 b
Aureofungin	37.2 b	15.5 e	23.5 d	31.7 cd	27.0 e
Carbendazim	41.7 b	42.0 c	22.2 d	36.2 b	35.6 bc
Chloronab	15.7 e	23.7 de	47.5 bc	32.5 cb	29.9 de
Quintazene	24.0 d	32.5 de	51.5 b	23.0 de	32.7 cd
Carboxin	30.2 c	23.2 de	39.7 c	27.5 cd	30.2 de
Control (CSA)	48.2 a	68.7 a	74.2 a	61.2 a	63.1 a

MP = *Macrophomina phaseolina*; FM = *Fusarium moniliforme*; FMS = *F. moniliforme* var. *subglutinans*; FS = *F. semitectum*.

Mean within each column followed by the same letter are not significantly different at P = 0.05 according to the Waller Duncan Bayesian *K*-ratio LSD rule.

Table 2. Analysis of variance (mean squares) for per cent colonization by four stalk rot pathogens under seven fungicide treatments

Source of variation	df	Mean sum of squares levels	LSD (P = 0.05%)
Replication	3	199.39	
pathogens	3	584.72*	7.560
Subplot error	9	79.01	
Fungicides	6	2410.08***	6.297
Fungi x Fungicides	18	518.99***	12.597
Main plot error	72	31.34	
Total	111		

* = F value significant at P = 0.05
*** = F value significant at P = < 0.001

(1980) observed that the presence of benomyl drastically reduced the CSA of *F. moniliforme* var. *subglutinans* in the soil. Our results are in confirmity with that of earlier workers.

Analysis of variance have shown highly significant variance (P = < 0.001) for different fungicides, stalk rot pathogens and their interactions (Table 2).

These results have demonstrated the high CSA of *F. moniliforme* var. *subglutinans* and other species of *Fusarium* and low CSA in *M. phaseolina*. Fungicides, particularly aureofungin, chloronab, quintazene and carbendazim reduced the CSA of the stalk rot pathogens in the soil. The action of the fungicides, pesticides, herbicies and other chemical substances have two fold action in the soil either by reducing the populaltion of the inoculant fungus or by changing the populations of the native soil microflora. The present study reveals the importance of fungicidal residues in the soil in affecting the survival of the sorghum stalk rot pathogens by curtailing them to colonize the substrates and thereby reducing the inoculum density for infection of the subsequent crop.

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