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Effect of Seed Treatment with Certain Soil Aspergilli on the Seed Germination and Seedling Growth of Paddy, Groundnut and Cotton

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ABSTRACT

Eight *Aspergillus* spp. *viz.*, *A. flavus*, *A. niger*, *A. terreus*, *A. fumigatus*, *A striatus*, *A. nidulans*, *A. tamarii* and *A. japonicus* were isolated from the soil and th effect of spore suspensions and culture filtrates on seed germination and seedling growt of paddy, groundnut and cotton were studied. The germination of paddy seeds treate with *A. flavus*, *A. terreus*, *A. nidulans* and *A. tamarii* was 15 to 38 per cent lower tha the control. However, spore suspensions and culture filtrates of *A. niger*, *A. terreus*, *A striatus* and *A. japonicus* did not markedly affect the seed germination of groundnut an cotton and also caused post-emergence rotting. Interestingly, the seedling growth wa stimulated to different degrees by the spore supspensions as well as the culture filtrate of the eight species of Aspergilli in one or more of the three crop species studied.

INTRODUCTION

Although much work was done on the influence of growing plants on the abundance and activities of soil microflora (Rovira and Mc Dougall, 1967 and Rangaswami, 1968), little information is avaibable on the effect of soil microflora on seed germination and plant growth. Rovira and Bowen (1960) reported stunting effect of soil microrganisms on the roots of subterranean clover (*T. subterraneum*). They also reported poor development of root hairs of the same species in non-sterile soil. The present study reports the effect of certain soil aspergilli a predominant group of soil mycoflora on the seed germination and plant growth of paddy, groundnut and cotton

MATERIALS AND METHODS

Eight species of *Aspergillus viz.*, *A. flavus*, *A. niger*, *A. terreus*, *A. fumigatus*, *A. striatus*, *A. nidulans*, *A. tamarii and A. japonicus* isolated from paddy field soil collected at the Annamalai University Experimental Farm, were used in the present study. Healthy seeds of paddy (ADT 27), groundnut (TMV 2) and Cotton (K 6) were surface sterilized with 0.1 per cent mercuric chloride for 3 min, washed in several changes of sterile distilled water, treated with conidial suspension of each isolate for 6 hr and dried in shade. The treated and surface sterili-

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TABLE 1. Effect of seed treatment with spore suspensions and culture filtrates of *Aspergillus* spp. on the germination of paddy, groundnut and cotton (per cent of seed germination)

Fungal isolate	Paddy		Groundnut		Cotton	
	Spore suspension	Culture filtrate	Spore supension	Culture filtrate	Spore suspension	Culture filtrate
A. flavus	57	63	19	58	28	45
A. niger	91	85	26	65	29	56
A. terreus	76	77	39	62	32	45
A. fumigatus	90	93	58	67	36	61
A. striatus	89	81	62	69	33	65
A. nidulans	79	83	56	78	44	75
A. tamarii	71	79	41	56	24	56
A. japonicus	86	89	28	62	32	55
Control	92	92	82	82	81	81

zed untreated seeds were transferred to sterile filter papers in sterile petridishes and germination counts were recorded up to one week.

The isolates were separately grown in Czapek's (Dox) browth (Ainsworth, 1961) under sterile conditions at room temperature (28±2°C) for 15 days and the cell free culture filtrate was obtained by filtering off the mycelial mat and centrifuging the filtrate at 2100 g for 10 min. The seeds of the above mentioned crop species were treated with the culture filtrate of each species for 6 hr and the germination counts of the treated seeds were recorded as detailed earlier.

The effect of the fungal isolates and their culture filtrates on the plant growth was studied by adding separately the conidial suspension and culture filtrate of each isolates to the sterile soil in pots and later sowing surface sterilized seeds. Growth measurements and phytotoxic symptoms if any, were recorded periodically up to 30 days.

RESULTS AND DISCUSSION

Christenson (1965) reported that the *Aspergillus* spp. occur most commonly on the surfaces of seed coats and cause reduction in germination percentage and damage to embryos. However, in the present study differential response was observed as regards to the effect of the eight *Aspergillus* spp. studied on the seed germination of paddy, groundnut and cotton (Table 1). Paddy seeds treated with the spore suspensions and culture filtrates of *A. flavus*, *A. terreus*, *A. nidulans* and *A. tamarii* was 15 to 38 per cent lower than the control. On the other hand spore suspensions as well as culture filtrates of the remaining species of *Aspergillus*, *viz.*, *A. niger*, *A. fumigatus*, *A. striatus* and *A. japonicus* did not markedly affect the germination of paddy seeds. Interestingly, however, all the eight species markedly retarded the seed germination of groundnut and cotton and also caused post-emergence rotting. In general spore suspensions had more inhibitory effect on the seed germination of groundnut and cotton than

TABLE 2. Effect of *Aspergillus* spp. on seedling growth of paddy, groundnut and cotton (Height of the plant in cm)

Fungal isolate	Paddy		Groundnut		Cotton	
	Spore suspension	Culture filtrate	Spore supension	Culture filtrate	Spore suspension	Culture filtrate
A. flavus	12.9	14.5	16.5	17.5	7.5	8.9
A. niger	12.6	17.3	9.8	16.4	11.5	9.6
A. terreus	12.3	17.2	12.5	18.6	10.9	9.2
A. fumigatus	12.3	15.1	18.5	19.1	9.6	9.2
A. striatus	13.9	14.1	14.4	20.1	8.9	10.1
A. nidulans	14.7	14.0	14.2	19.0	10.9	10.2
A. tamarii	11.8	14.9	16.2	16.8	10.5	10.8
A. japonicus	14.9	10.2	12.6	14.9	9.5	9.5
Control	13.5	13.5	16.9	16.9	9.0	9.0

the culture filtrates. Production of mycotoxins like flavicidic acid (Hummel, 1956), aspergillomerasmine A and B and anhydromerasmine B from *A. flavus* (Robert *et al.*, 1962) were reported earlier. Takahasi and Curtis (1961) also reported malformin from the culture filtrates of *A niger*. *A. flavus* *A. niger*, *A. parasiticus*, *A. ruber* and *A. ventii* have been reported to produce aflatoxin (Goldblatt, 1968). Robert *et al.* (1962) stated that aspergillomerasmine A and B and anhydromerasmine B were found to exhibit strong wilting action on tomato plants like lycomerasmic acid. The inhibitory effect of eight fungal isolates studied on seed germination of the three crop species may be attributed to their capacity to produce toxins. Since the different isolates exhibited differential effect on the seed germination, detailed studies on the mycotoxins produced by different species of soil Aspergilli and their differential action on the seed germination of different crop plants will, therefore, be of great value

Interestingly, spore suspensions and culture filtrates of different species did not affect the seedlings growth of paddy, groundnut and cotton, excepting spore suspensions of *A. niger*, *A. terreus* and *A. japonicus* on groundnut and the spore suspensions of *A. flavus* on cotton (Table 2). Also, the seedling growth was stimulated to different degrees by the spore suspensions as well as culture filtrate of the eight isolates in one or more of the three crop species studied. Naim (1956) reported that *A. terreus* treated cotton plants showed vigorous growth and addition of the same to sterile soil also ennanced plant growth. Although, piricularin, a toxin produced by rice blast pathogen *Pyricularia oryzae* Cav-inhibited the peroxidase, catalase, cytochrome oxidase and ascorbic acid oxidase activities of rice leaves (Tamari, 1959; Tamari *et al.*, 1965) and caused remarkable accumulation of coumarin which manifested a stunting effect in plants (Tamari *et al.*, 1965 and 1967), interestingly. lower concentrations stimulated respiration and growth of rice plants (Tamari and Kaji, 1955, 1959). It is quite probable that the toxins produced by the *Aspergillus* spp. may be acting similarly as that of piricularin in stimulating the seedling growth.

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