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STUDIES ON EFFECT OF SEED-BORNE FUNGI ON GERMINATION OF SUNFLOWER

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SUMMARY

Eleven naturally infected and four uninfected sunflower seed samples collected from different production areas of Pakistan were tested for seed germination. Germination in all the infected sunflower seed samples was significantly lower as compared with healthy samples. The seed samples having high infection of *Alternaria alternata* (Fr.) Kessler alone reduced the germination to the same extent when its infection was low but in combination of other pathogens especially with *Fusarium* spp. and *Macrophomina phaseolina* (Tassi) Goid. The number of abnormal seedlings and the recovery percentage of various seed borne fungi from the abnormal seedlings during germination was dependent on their infection level in the seed.

Key words: Sunflower, seed germination, abnormality, seed-borne fungi

INTRODUCTION

High price of hybrid seed and awareness in pest management has forced the sunflower farmers to use disease free quality seed. So seed should have assurance of high germination. Of the various disease causing organisms, fungi are known to be primarily involved in seed and seedling complex disorders and subsequently in the causation of field diseases in sunflower. Seed-borne fungi caused 20-30 percent reduction in yield. A high mortality at the pre-emergence and a yield reducton of 20-30% by seed borne fungi is reported for this crop (Jhamaria *et al.*, 1975 and Chandra *et al.*, 1985). In Pakistan, more than twenty fungi are reported to be seed-borne in sunflower (Ghafoor and Khan, 1974; Dawar and Ghaffar, 1991; Ahmad *et al.*, 1992; and Bhutta *et al.*, 1993). The quantative role of fungi in seed germination is not known in detail. A study was conducted to determine the effect of mycoflora on

germination and its role in causation of abnormalities during germination. Such information may be considered crucial in disease management decision making.

MATERIALS AND METHODS

Selection of seed samples

Eleven seed samples naturally infected with various seed-borne fungi and four uninfected samples were used in this study (Table 1). These samples were selected from 196 seed samples tested using standard blotter paper method. The selection criteria of these samples was number of different types of fungi present. The samples under test were collected from imported seed stock in case of SF-100 & NK-212 and from locally produced seed stock in case of Ho-1 & Suncome-90. Healthy seed samples of the above hybrids/varieties served as control.

Germination test

Four hundred seeds of each seed sample were placed separately on anchor brand paper (size 24x48 cm) in four replications without any surface sterilization. Each replication was 100 seeds. Paper with seed was rolled, put in polythene bags and incubated at 20-25°C for eight days. Moisture was provided to keep the paper wet. After eight days, the paper rolls were opened and seedlings were examined individually for the categories such as normal seedlings, abnormal seedlings and dead/ ungerminated seeds, in percentage.

To establish the quantitative role of seed-borne fungi in germination, ungerminated seed and abnormal seedlings were further tested. Ungerminated seeds were placed on blotter paper for detection of fungi. Abnormal seedlings were placed on blotter paper using component plating technique (Mathur *et al.*, 1985). Portions of only two seedlings (roots stem and leaf) were plated in one glass petri dish (dia. 9 cm) and incubated for eight days at 20°C (± 2) under daylight fluorescent tube light. Fungal growth was examined on individual parts of seedlings with the help of a stereoscopic microscope. Fungi were identified based on their habit characters (Barnett, 1960; Ellis, 1971; and Nelson *et al.*, 1983). Results were expressed in percentages and statistically analysed.

RESULT AND DISCUSSION

Infected seed samples used in this study were naturally infected with *Alternaria alternata*, *Emericelopsis terricola*, *Fursarium moniliforme*, *F. semitectum*, *F. solani*, *Macrophomina phaseolina*, *Phoma oleracea*, *Stemphylium helianthi* and *Verticillium dahliae*. Germination in all infected sunflower seed samples was significantly lower as compared with the healthy samples (Figures 1,2,3,4). The seed samples having high infection of *A. alternata* alone reduced the germination to

Table 1: Seed infection percentage of samples used for germination studies

Variety/ Hybrid	Locality	Fungi	Percentage	Remarks
SF-100	Lahore	Nil	0.0	Control
SF-100	Multan	*Alternaria alternata*	55.5	
SF-100	Hyderabad	*A. alternata*	16.00	
		F. semitectum	0.5	
		F. solani	1.0	
		Stemphylium helianthi	0.5	
SF-100	Islamabad	*A. alternata*	49.50	
Ho-1	Sanghi (Sukkur)	Nil	0.0	Control
Ho-1	Peshawar	*A. alternata*	59.5	
		Emericellopsis terricola	10.5	
		F. semitectum	2.0	
		F. solani	2.0	
		Stemphylium helianthi	1.0	
Ho-1	D.I.Khan	*A. alternata*	70.0	
		E. terricola	1.5	
		F. moniliforme	0.5	
		F. semitectum	1.0	
Ho-1	ARI,Tandojam	*A. alternata*	44.5	
		E. terricola	3.5	
		F. semitectum	1.0	
		Verticillium dahliae	0.5	
NK-212	R.Y. Khan	Nil	0.0	Control
NK-212	D.I.Khan	*A. alternata*	74.5	
		E. terricola	2.5	
		Drechslera tetramera	1.0	
		F. moniliforme	2.5	
		F. semitectum	1.5	
NK-212	Faisalabad	*A. alternata*	57.0	
		Drechslera tetramera	1.0	
		Marcrophomina phaseolina	5.0	
		Phoma oleracea	2.0	
Suncome-90	Khanpur	Nil	0.0	Control
Suncome-90	Faisalabad	*A. alternata*	57.0	
		D. tetramera	1.0	
		F. moniliforme	3.0	
		F. solani	2.0	
		F. semitectum	5.0	
		S. helianthi	6.0	
Suncome-90	Khanpur	*A. alternata*	96.5	
		E. terricola	1.5	
Suncome-90	Faisalabad	*A. alternata*	29.0	
		D. longirostrata	3.0	
		D. tetramera	1.0	
		F. semitectum	2.0	

same extent when its infection was low but in combination with other pathogens especially *Fusarium* spp. and *M. phaseolina*.

Table 2: Percentage of fungi isolated from sunflower seedlings showing various abnormalities in germination test

Varieties /hybrids	Fungal recovery abnormal seedling	(%) from	Fungal recovery Ungermination seed	(%) from	Remarks
SF-100	-	0.0	-	0.0	Control
SF-100	*Alternaria alternata*	18.75	*A. alternata*	8.33	
	F. moniliforme	1.56			
SF-100	*A. alternata*	7.5	*A. alternata*	5.0	
	F. solani	2.5			
SF-100	*A. alternata*	16.67	*A. alternata*	8.33	
Ho-1	-	0.0	-	0.0	Control
Ho-1	*A. alternata*	19.74	*A. alternata*	12.5	
	F. semitectum	1.32			
	F. solani	2.50			
	Stemphylium helianthi	1.32			
Ho-1	*A. alternata*	19.45	*A. alternata*	3.57	
	F. semitectum	1.39			
Ho-1	*A. alternata*	10.94	*A. alternata*	6.25	
	Verticillium dahliae	1.56			
	Emericellopsis tericola	1.56			
NK-212	-	-	-	0.0	Control
NK-212	*A. alternata*	21.05	*A. alternata*	3.85	
	F. moniliforme	2.63	*E. terricola*	1.93	
	F. semitectum	1.31			
NK-212	*A. alternata*	20.75	*A. alternata*	12.5	
	Macrophomina phaseolina	3.75	*M. phaseolina*	2.5	
	Phoma oleracea	2.0			
Suncome-90	-	0.0	-	0.0	Control
	A. alternata	16.66	*A. alternata*	12.5	
	F. moniliforme	2.77			
	F. solani	1.38			
	F. semitectum	2.77			
	S. helianthi	2.77	*S. helianthi*	3.12	
Suncome-90	*A. alternata*	25.00	*A. alternata*	10.0	
Suncome-90	*A. alternata*	7.5	*A. alternata*	6.25	
	F. semitectum	2.5			
	Drechslera longirostrata	2.5			

Abnormal seelings were found in higher percentage in seed samples infected with various types of seed-borne fungi. *A. alternata* in combination with *Fusarium* spp. and *V. dahliae* and *M. phaseolina* in combination with *A. alternata* gave higher percentages of abnormal seedlings than the other fungi (Table 2). In seed

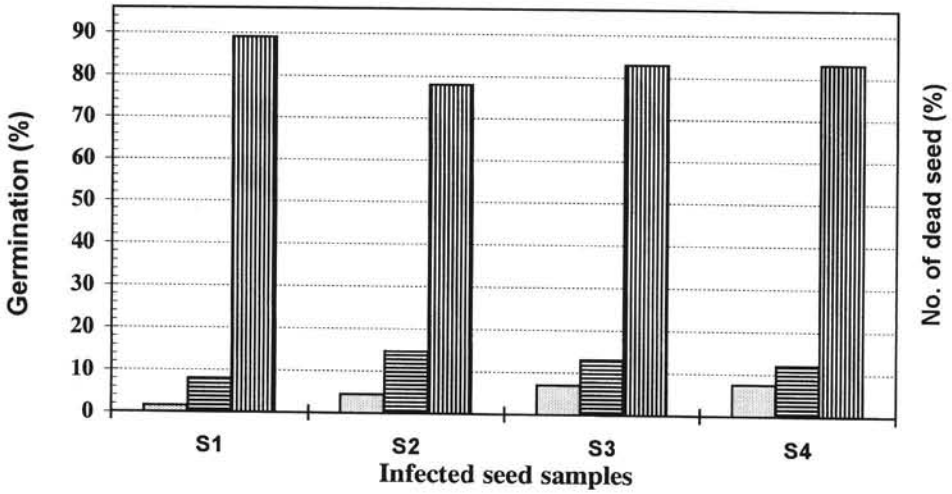


Figure 1. Effect of pathogens on germination of sunflower cultivar SF-100

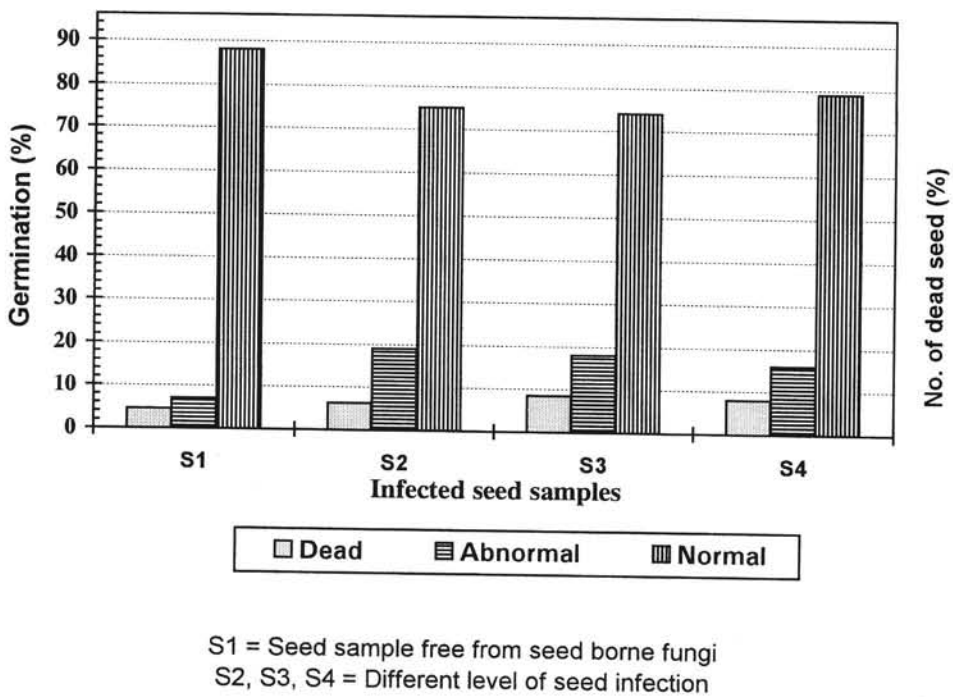


Figure 2. Effect of pathogens on germination of sunflower cultivar Ho-1

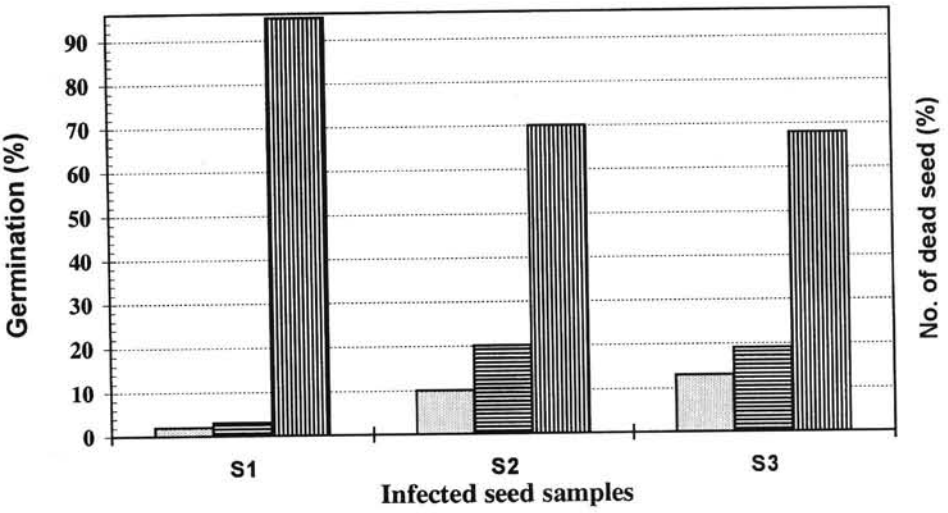
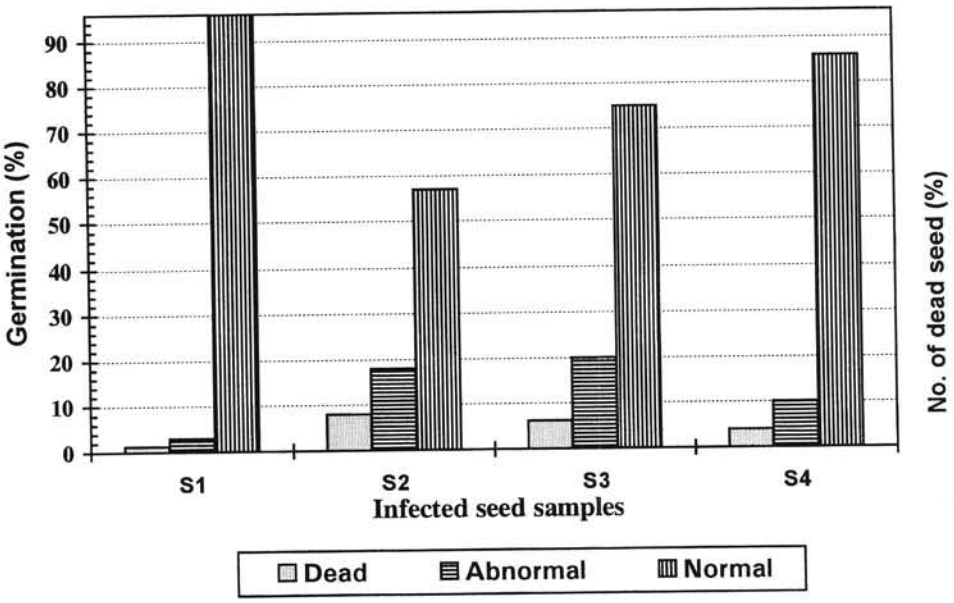


Figure 3. Effect of pathogens on germination of sunflower cultivar NK-212



S1 = Seed sample free from seed borne fungi
S2, S3, S4 = Different level of seed infection

Figure 4. Effect of pathogens on germination of sunflower cultivar Sc-90

samples with seed infection with *A. alternata* of 49.50 to 55.5%, the fungal recovery from abnormal seedlings was 16.67 to 18.75 percent. Increase in recovery of pathogens from abnormal seedlings corresponded to the increase in the percentages of pathogens in seed (Balasubrahmanyam and Kotle, 1980). Maximum recovery of 25.0 percent from abnormal seedlings was observed in Suncome-90, having 96.5 percent seed infection of *A. alternata*. In the case of *M. phaseolina*, 3.75 percents were found on abnormal seedlings. The seed samples had only 5.0 percent seed infection with *M. phaseolina*. Ungerminated seeds which were found fresh or hard during germination were also incubated. Seed-borne fungi were isolated in varying degree (Table 2).

CONCLUSIONS

This study shows that role of the tested fungi in causation of various abnormalities depend on their inoculum level in the seed. To ensure optimum planting value of any seed lot, ordinary germination test is not sufficient and it should be replaced with vigour test.

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ESTUDIOS SOBRE EL EFECTO DE HONGOS DE LA SEMILLA SOBRE LA GERMINACIÓN DE GIRASOL

RESUMEN

La germinación en todas las muestras de semillas de girasol infectadas fue significativamente disminuida en comparación con muestras sanas. Las muestras de semilla teniendo alta infección de *A. alternata* solamente redujeron la germinación hasta el mismo nivel cuando su infección fue baja pero en combinación con otros patógenos especialmente con especies de *Fusarium* y *M. phaseolina*. En un estudio concerniente al papel de la microflora de la semilla como causante de varias anormalidades durante la germinación *A. alternata* fue detectada hasta el 25.0% mientras *M. phaseolina* fue encontrada hasta el 3.75% valores comparables con el nivel de infección en la semilla. Se concluye que el papel de estos hongos como causantes de anormalidades depende de su nivel de inóculo en la semilla.

ETUDES DE L'EFFET DES CHAMPIGNONS TELLURIQUES DE LA GRAINE SUR LA GERMINATION DU TOURNESOL

RÉSUMÉ

La germination des lots de graines de tournesol infectées est significativement plus faible que celle des lots sains. Les échantillons de graines ayant subi une forte infection uniquement par *A. alternata* voient leur germination réduite du même ordre qu'une faible infection combinée impliquant d'autres pathogènes et particulièrement *Fusarium* ssp et *M. phaseolina*. Dans une étude du rôle de la mycoflore des graines sur les anomalies de germination, on a détecté un effet de *A. alternata* pouvant atteindre 25.0 pourcent du niveau d'infestation de la graine alors que cet effet n'est que de 3.75 pourcent chez *M. phaseolina*. On en conclut que le rôle de ces champignons dans les anomalies de germination dépend du niveau d'inoculum dans la graine.