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STUDIES ON SEED-BORNE FUNGI OF WHEAT IN SINDH PROVINCE AND THEIR EFFECT ON SEED GERMINATION

M. ASLAM RAJPUT, MUMTAZ. A. PATHAN[*], A. MUBEEN LODHI[**], G. SARWAR SHAH* AND KHALIL A. KHANZADA[***]

National Sugar Crop Research Institute Thatta, [*]Sindh Agriculture University, Tandojam,[**]Department of Botany, University of Karachi, [***]Crop Disease Research Institute, Karachi.

Abstract

One hundred twenty wheat seed samples collected from Sindh wheat growing areas were tested for fungal seed-borne pathogens by using the standard blotter method. Five seed borne fungi viz., *Alternaria tenuis, Aspergillus niger, Fusarium moniliforme, Curvuluria lunata* and *Stemphylium herhurum* were isolated from 12 wheat varieties *viz*., Mehran, T.J-83, Soghat, Sarsabz, Anmol, Johar, C-591, Sindh-81, Pak-70, Mexipak-65, H-68 and Faisalabad-85 respectively. *Alternaria tenuis* was predominance with an infection range from 22.5-47.5%. Maximum seed germination was observed in Anmol and minimum in Pak-70. Maximum root and shoot length of seedlings was recorded in Anmol and Sarsabz followed by H-68 and minimum in Pak-70, Mehran-89, Soghat and Johar.

Introduction

Wheat plants at all stages of growth are subject to numerous injuries and stresses, which interfere with their normal functioning and development. Each year about 20% of the wheat that other wise would be available for food and feed is lost due to diseases (Fakir, 1999). Seed health plays an important role for successful cultivation and yield exploitation of a crop species. Among various factors that affect seed health, the most important are the seed borne fungi that not only lower seed germination, but also reduce seed vigor resulting in low yield. Healthy seed plays an important role not only for successful cultivation but also for increasing yield of crop. Seed-borne pathogens of wheat are responsible to cause variation in plant morphology and also reducing yield up to 15-90 % if untreated seeds are grown in the field (Wiese, 1984). Several seed-borne pathogens are known to be associated with wheat seed which are responsible for deteriorating seed quality during storage. Kamal & Mughal (1968) and Khan *et a!*., (1974) noted the presence of several fungi, i.e., *Alternaria, Helminthosporium, Fusarium, Curvularia, Stemphylium, Rhizopus, Cladosporium, Aspergillus,* and *Penecillium* species in wheat seeds. Gill & Tyagi (1970) recorded 30-40% incidence of Alternaria *tenuis* on high yielding wheat varieties in some districts of Punjab. Khan & Bhutta (1994) and Bhutta & Hussain (1999) isolated *Drechslera* sorokiniana and *Fusarium* moniliforme as major pathogens from 1267 and 246 wheat seed lots during 1985-90 and 1993-94 to 1996-97 respectively. Grezelk and Szyrmer (1982) isolated *Alternaria tenuis, Botrytis cinerea, Fusarium aynaceum,* and *F. culmorum* predominant from triticale seeds. Singh (1983) recorded *Aspergillus* spp., followed by *Drechslera, Penicillium* and *Fusarium* spp., associated with wheat seeds. Martin *et at.,* (1984) isolated *Alternaria, Curularia, Fusarium, Aspergillus,* and *Penicilium* spp., as major storage fungi from wheat grains. Ghosh and Nandi (1986) reported that several of

Aspergillus, Penicilium jenseni are responsible for deteriorating wheat grains during storage. Kunwar (1989) isolated *Aspergillus* spp., *Penicilium* spp., followed by *Alternaria alternata* from 50% samples of the stored wheat seeds. Dharmvir, *et al*., (1968) observed that fungi colonized during storage were responsible for reducing plant population by 42% in the field. The present report gives an account of seed borne fungi isolated from 12 wheat varieties cultivated in the province of Sindh, Pakistan.

Materials and Methods

Ten samples of each of twelve wheat varieties *viz*., Mehran, T.J-83, Soghat, Sarsabz, Anmol, Johar, C-591, Sindh-81, Pak-70, Mexipak-65, H-68, and Faisalabad-85 were collected from wheat growing areas of Sindh *viz.*, Hyderabad, Mirpurkhas, Nawabshah, Dadu, Khairpur and Sukkhur. Isolation was made from 200 seeds of each variety under aseptic conditions by standard blotter method. After 6-7 days incubation, the fungi associated with seeds were identified on the basis of their typical colony characteristics and conidial morphology (Kamal & Mughal, 1968; Khan *et a!*., 1974; Grezelk & Szyrmer, 1982; Sejiny *et al.*, 1984). Germination studies were conducted by taking 200 seeds per variety, surface sterilized with 0.01% mercuric chloride and plating them in sterilized Petri dishes with three layers of blotter papers moistened with sterilized water. The Petri dishes were kept for 7 days at 25±1ºC. Germination studies were also carried out in earthen pots of 22 cm diameter, containing sterilized soil, by growing 200 seeds of each variety. The seeds were covered with a uniform layer of soil and irrigated whenever needed. All tests were replicated eight times. The germination was counted when the first leaf of the seedling reached to a length of 4.0 cm. The root and shoot lengths of germinated seedlings were also recorded.

Results and Discussion

A total of five fungal species viz., *Alternaria tenuis, Aspergillus niger, Stemphylium herbarum, Fusarium moniliforme,* and *Curvularia lunata* were isolated from the seeds of 12 wheat varieties (Table1). The frequency of association of wheat seed microflora was influenced by varieties tested. The highest frequency of seed microflora was observed on wheat variety Pak-70 followed by Mehran-89, Soghat, and Johar, with lowst fungal frequency recorded from the seeds of wheat variety Anmol followed by Sarsabz, H-68 and Sindh-81. Of the fungi isolated *A. tenuis* was the most predominant fungus (22.5-47.5 %) followed by *A. niger* (3.5-15 %), *S. herbarum* (2.5-14%), *F. moniliforme* (1.5-7.5 %), and *C. lunata* (1-3.5%) (Table 1). *C. lunata* was isolated from 5 varieties and *F. moniliforme* from 8 wheat varieties. However, the remaining 3 fungal species were isolatd from all the 12 varieties. Kamal and Mughal (1968), Khan *et al.*, (1974) and Bhutta & Hussain (1999) observed the presence *of Alternaria, Helminthosporium, Fusarium, Curvularia, Stemphylium, Rhizopus, Cladosporium, Aspergillus,* and *Penicillium* species in wheat seeds. Grzelk and Szymer (1982) also found *A. tenuis, Botrytis cinerea* and *Fusarium* spp., as predominant fungi from triticale seeds. Such similar reports have been made by Singh (1983), Martin, *et al.*, (1984) and Sejiny *et al.*, (1984). Ghosh and Nandi (1986) observed that several species of *Aspergillus* and *Penicilium jenseni* are responsible for deteriorating wheat grains during storage. Kunwar (1989) also isolated *Aspergillus* spp., *Penicillium*, spp., followed by *A. alternata* from 50% samples of the stored wheat seeds.

Table 1. Frequency of fungi associated with seeds of 12 wheat varieties.

Wheat varieties	Total no. of seed studied	Seed-borne fungi isolated	No. of infected grains with fungi	Percentage
Pak-70	200	*A. tenuis*	95	47.5
		A. niger	30	15.0
		S. herbarum	28	14.0
		F. moniliforme	15	7.5
		C. lunata	07	3.5
Mehran-89	200	*A. tenuis*	85	42.5
		A. niger	26	13.0
		S. herbarum	25	12.5
		F. moniliforme	12	6.0
		C. lunata	05	2.5
Soghat	200	*A. tenuis*	68	34.0
		A. niger	20	10.0
		S. herbarum	20	10.0
		F. moniliforme	08	4.0
		C. lunata	-	-
Johar	200	*A. tenuis*	65	32.5
		A. niger	18	9.1
		S. herbarum	16	8.0
		F. moniliforme	10	5.0
		C. lunata	03	1.5
C-591	200	*A. tenuis*	63	31.5
		A. niger	17	8.5
		S. herbarum	16	8.0
		F. moniliforme	09	4.5
		C. lunata	-	-
Mexipak-65	200	*A. tenuis*	58	29.0
		A. niger	15	7.5
		S. herbarum	17	8.5
		F. moniliforme	06	3.0
		C. lunata	-	-
H-68	200	*A. tenuis*	46	23.0
		A. niger	12	6.0
		S. herbarum	07	3.5
		F. moniliforme	-	-
		C. lunata	-	-
Sarsabz	200	*A. tenuis*	44	22.0
		A. niger	08	4.0
		S. herbarum	06	3.0
		F. moniliforme	-	-
		C. lunata	02	1.0
Anmol	200	*A. tenuis*	45	22.5
		A. niger	07	3.5
		S. herbarum	05	2.5
		F. moniliforme	03	1.5
		C. lunata	-	-
T.J-83	200	*A. tenuis*	55	27.5
		A. niger	14	7.0
		S. herbarum	15	7.5
		F. moniliforme	-	-
		C. lunata	-	-
Faisalabad-85	200	*A. tenuis*	52	26.0
		A. niger	13	6.5
		S. herbarum	11	5.5
		F. moniliforme	04	2.0
		C. lunata	-	-
Sindh-81	200	*A. tenuis*	48	24.0
		A. niger	12	6.0
		S. herbarum	09	4.5
		F. moniliforme	-	-
		C. lunata	-	-

Table 2. Germination of infected and healthy seeds of 12 wheat varieties in pot and laboratory experiments.

Varieties	Germination Percentage	
	Pots	Lab
Anmol	68.0	90.0
Sarsabz	65.5	88.75
H-68	65.25	88.25
Sindh-81	64.5	88.0
Faisalabad-85	63.5	87.0
T.J-83	61.0	86.25
Mexipak-65	58.75	85.0
C-591	56.25	82.0
,Johar	55.5	79.5
Soghat	54.0	77.75
Mehran-89	49.25	74.25
Pak-70	45.25	71.5

Table 3. Effect of fungi on root length and shoot length of germinated seedlings of wheat.

Varieties	Root length (cm)	Shoot length (cm)
Anmol	4.4 a	9.20 a
Sarsabz	3.73 ab	8.00 ab
H-68	3.67 abc	7.78 b
Sindh-81	3.57 abcd	7.32 bc
Faisalabad-85	3.50 abcd	7.25 bc
T.J-83	3.40 abcd	7.13 bc
Mexipak-65	3.10 bcdef	6.10 c
C-591	2.65 cdef	6.03 c
,Johar	2.60 def	4.37 d
Soghat	2.57 def	3.17 de
Mehran-89	2.40 ef	3.10 de
Pak-70	2.10 f	2.60 f

Germination of seeds was low in pots (45.25-68% as compared to the Petridishes (71.5-90%) (Table 2). In both experiment, the maximum germination was recorded in Anmol followd by Sarsabz, H-68, Faisalabad-85, T.J-83 and Mexipak, whereas, Pak-70 followd by Mehran showed minimum germination. It was also evident from our results that inculum pressure can be directly correlated with the intensity of disease development since in our experiment highest frequency of fungi was recovered from the variety Pak-70 that also showed minimum germination. Dharmvir, *et al.,* (1968) also reported reduction in the germination of wheat seed due to fungi colonizing during storage. Oppitz and Hoesser (1979) reported that seed borne pathogens of wheat not only reduced the germination but also affected seedling vigor resulting in low yield. Dorovskaya and khasanava (1974) observed the reduction in the germination of wheat seedlings due to injuries on wheat seed by *Helminthosporium sativum, Cladosporium herbarum, A. tenuis,* and *Fusarium* species. Rees, *et al.,* (1984) also recorded quality changes in wheat seed by *A. alternata.* Sulaiman and Husain (1984) observed that *Aspergillus flavus* reduced 90% germination of wheat seeds as compared to healthy seeds. Mahmuda (l987) detected *Alternaria alternata* to be predominant causing 82% reduction in germination of wheat seeds.

The maximum root length was obtained in plants of Anmol followed by plants of Pak-70, and Mehran-89 (Table 3). There was no significant difference in the root lengths of Sindh-81 and Faisalabad-85, Soghat and Johar varieties. The shoot length of plants was recorded in Anmol and Sarsabz followed by H-68. This was significantly lower in Pak-70, Mehran and Soghat followed by Johar (Table 3). The results are in accordance with Oppitz and Hoesser (1979) reported that seed borne pathogens of wheat not only reduced the germination but also affected seedling vigor that resulting in low yield.

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