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BLACK POINT OF WHEAT IN COMMERCIAL VARIETIES OF SINDH, PAKISTAN

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ABSTRACT

Seed samples of commercial wheat varieties were tested for fungi associated with black point diseases by using ISTA technique. Disease incidence of black point was varied in 19 commercial varieties without significant effect on seed germination whereas the wheat varieties viz., Punjnad , Mehran-98 and Chakwal-50 harbored *Alternaria* and *Fusarium* in high percent and was found significant. Punjnad showed highest black point incidence 32 % followed by Mehran-89 (26 %), Fareed-08 (23.7 %). Six fungal genera including both saprophytic as well as pathogenic were encountered. Species of *Alternaria* were found predominant followed by *Aspergillus, Drechslera, Fusarium, Cladosporium* and *Curvularia.*

Key words: Wheat; black-point; *Alternaria; Fusarium*; *Aspergillus, Drechslera, Cladosporium* and *Curvularia.*

INTRODUCTION

Black point is browning and black discoloration at the embryo end of the wheat grain. Fungal infection is the main link to black point symptoms causes substantial financial losses to wheat growers due to down-grading of wheat (Yunxian *et al.*, 2006). It is prevalent in major wheat growing areas of the world including Australia, Canada, United States, Africa, India, Bangladesh, New Zealand and Europe (Hoyle, 1999). Black point is mostly present in durum wheat (McIntosh, 1998; Sharma, 2012) and also common in bread wheat (Hannan *et al.*, 2005). In Pakistan commonly present in various wheat cultivars grown in different parts of the country (Kamal and Moghal, 1968, Khan and Bhutta, 1994). Black point is usually caused by *Alternaria alternata,* followed by *Bipolaris sorokiniana, Cladosporium cladosporioides, Cochliobolus sativus Curvularia lunata* and *Fusarium* spp. (Fakir *et al.*, 1989; Dey *et al.*, 1992; Fernande and Conner, 2011). *Bipolaris sorokiniana* is an important pathogen of black point disease of wheat and was reported from many wheat growing countries of the world (Fakir *et al.*, 1989; Ahmed *et al.*, 1994; Fakir, 1998; Mathur and Cunfer, 1993; Zishan *et al.*, 2005; Hasabnis *et al.*, 2006). In Pakistan seedling blight and root rot of wheat caused by *B. sorokiniana* (Hafiz,1986; Kishwar *et al*,1992) and in hot and humid areas it was found associated with most of the foliar blight samples of wheat (Iram and Ahmed, 2004). *A. alternata* alone has also been reported to cause black point disease (Dharam Vir *et al.*, 1968; Khan and Bhutta, 1994). Many of these fungi are saprophytic growing on dead plant material such as crop residues and are relatively harmless. Black point pathogenic fungi including *Cochliobolus sativus* synonym *Bipolaris sorokiniana* and *Fusarium* spp., may reduce germination or increase the incidence of seedling blight. In severe black point infection reduction in seed germination, seedling vigour and grain yield have been reported (Rahman and Islam, 1998; Hossain, 2000; Malaker and Mian, 2002). *Fusarium* infection of seed could influence the quality of seed and have potential effects on the next crop (Wiese, 1977). In the present study fungi viz., *Alternaria, Aspergillus, Cladosporium, Curvularia, Dreschslera* and *Fusarium* species are found responsible of black point diseases of wheat and seed viability of commercial wheat varieties of Sindh, Pakistan.

MATERIALS AND METHODS

Seeds of 19 commercial wheat varieties were taken from the harvested wheat crops grown in the experimental field of Crop Diseases Research Institute, Karachi. A total of 19 seed samples of wheat varieties were analyzed in laboratory by using ISTA techniques (ISTA, 2010).

Dry Examination: Seed sample of each cultivar of both seasons was examined visually and under Stereo binocular microscope for detection of black discoloration of embryo region. Discolored seed were separated and manually counted to determine disease incidence. Percent incidence of black point was calculated separately for each cultivar.

Standard Blotter Method: As suggested by ISTA, 400 seeds drawn from each sample were plated in 16 Petri dishes of 9 cm diameter. Twenty five seeds were equidistantly placed over three layered well soaked blotter papers

per dish. The dishes were incubated under 12 hours alternating cycles of artificial daylight (ADL) and darkness at 24°C ± 1°C. Seeds were surface disinfected with 2% $Na(OCl)_2$ for 2 minutes before placing the seeds on blotter paper. The seed were examined after 7-10 days for germination and for the presence of fungi. The data were statistically analyzed using Duncan multiple range test and compared means by SPSS version 19.

RESULTS AND DISCUSSION

The seed samples of commercial wheat varieties were collected from the experimental field of Crop Diseases Research Institute, Karachi were tested initially, by employing dry examination and results are presented in Table 1. Disease incidence of black point was varied in 19 commercial varieties. The effect of black point infection on seed germination was not significant whereas the wheat varieties viz., Punjnad, Mehran-89 and Chakwal-50 showed Alternaria and *Fusarium* in high percent (Table 2).

Table 1. Black Point Incidence and Germination in seed samples of commercial wheat varieties collected from Crop Diseases Research Institute, Karachi.

S. No.	Wheat Varieties	Black Point Incidence (%)	Germination (%)
1.	AAS-09	12.5^{h}	92.6^{gh}
2.	Bahawalpur-2000	9.5^{f}	95.0^{hij}
3.	Bathoor-08	8.2^{e}	96.0^{hij}
4.	Chakwal-50	6.2^{d}	76.0^{e}
5.	Darawar- 99	12.4^{h}	80.1^{f}
6.	Durum-97	6.7^{d}	100.0^{l}
7.	Fareed-08	23.7^{j}	97.0^{jkl}
8.	Faisalabad-08	16.2^{i}	99.0^{kl}
9.	Gauarab	9.6^{f}	97.0^{jkl}
10.	Kanchan	11.1^{g}	72.0^{cd}
11.	Manther -03	3.2^{c}	48.4^{a}
12.	Mehran-89	26.0^{k}	69.0^{c}
13.	Mexipak	1.2^{a}	61.6^{b}
14.	Moomal-2002	2.4^{bc}	52.0^{a}
15.	Punjnad	32.0^{l}	48.3^{a}
16.	Saleem-2000	2.2^{abc}	94.3^{gh}
17.	Tandojam-83	6.2^{d}	75.7^{de}
18.	Wafaq-2001	6.0^{d}	90.8^{g}
19.	Zarlashta	1.7^{ab}	100.0^{l}

Mean followed by the same letter within a column are not significantly different at (P=0.05) according to Duncan's multiple range test.

Cromey and Mulholland (1988) reported that there was no consistent difference in germination between black pointed and symptomless grains. Black point associated with *Alternaria* spp. had no detrimental effect on germination of the affected kernels, but *Cochliobolus sativus* (Ito and Kurib.) Drechs. ex Dast. [anamorph *Bipolaris sorokiniana* (Sacc.) Shoemaker] reduced germination (Femandez, 1994). Punjnad harbored highest black point incidence 32 % followed by Mehran-89 (26 %), Fareed-08 (23.7 %). Black point incidence ranged from 11.1-16.2 in Kanchan, Darawar-99, AAS-09 and Faisalabad-08; 6.0-9.6 % in Wafaq-2001, Tandojam-83, Chakwal-50 , Durum-97, Durum-97, Bahawalpur-2000 and Gauarab; 1.2-3.2% in Mexipak, Zarlashta , Saleem-2000, Moomal-2002 and Manther-03. Six fungal genera including both saprophytic as well as pathogenic were encountered (Table 2). Species of *Alternaria* were found predominant followed by *Aspergillus, Drechslera, Fusarium, Cladosporium* and *Curvularia*. The fungi commonly involved in the black point disease of wheat include *Alternaria alternata, Bipolaris sorokiniana, Cladosporium cladosporioides, Curvularia lunata* and *Fusarium* spp. (Fakir *et al.,* 1989; Dey *et al.,* 1992). Species of *Fusarium* were the most frequent detected on wheat seeds of three commercial varieties

viz., Chakwal-50, ., Punjnad and Mehran-89 (Table 3). Researchers reported that black point kernels infected with *Fusarium tricinctum, F. proliferatum, F. avenaceum* and *F. equiseti* displayed higher mycotoxins contamination than symptomless kernels (Christ *et al*., 2011, Conner *et al.*, 1996 Desjardins *et al*., 2007; Golinski *et al*., 1996). The genetically defined strains of *F. proliferatum* can cause black point and fumonisin contamination in wheat kernels (Desjardins *et al.,* 2007). Black point has adverse effects on seed weight, germination and grain yield. The germination of black point affected seeds was reduced to a great extent as compared to healthy grains (Khanum *et al.,* 1987). However, the reduction in germination was found to be related with the severity of black point infection (Dhruj, 1991). Discoloured grains were found to be heavier than the normal ones (Toklu *et al*., 2008) whereas the higher black-point disease incidences as the lower crop yield parameters had estimated ones (Draz *et al.,* 2016). Variation in response of wheat cultivars to the kernel black-point disease was reported by many authors (Zishan *et al*., 2005, Beniwal *et al.*, 2005 and Wang *et al*., 2006) but no variety is known to be completely resistant to black point (Davis and Jackson, 2002). Environmental conditions of cultivated area play a great role in disease incidence (Beniwal *et al*., 2005 and Jain *et al*., 2012). Li *et al.* (2014) found 8.9% wheat genotypes were highly resistant to black point disease and strongly affected by genetic factors compared to environmental factors.

Table 2. Fungi associated with seed samples of commercial wheat varieties.

Wheat Varieties	Percent Incidence of Fungi						
	Alternaria alternata	*Aspergillus* sp.	*Cladosporium cladosporioides*	*Curvularia lunata*	*Drechslera* sp.	*Fusarium* sp.	Total
AAS-09	12.0	06.0		01.0	05.0	01.0	25.0
Bahawalpur-2000	18.0	26.0	02.0	01.0	13.0	-	60.0
Bathoor-08	24.0	07.0	04.0	01.0	02.0	-	38.0
Chakwal-50	23.0	20.0	05.0	01.0	13.0	25.0	87.0
Darawar 99	25.0	-	-	-	-	-	25.0
Durum-97	24.0	04.0	06.0	-	05.0	-	39.0
Fareed-08	15.0	08.0			19.0		42.0
Faisalabad- 08	14.0	07.0	13.0	02.0	26.0	-	62.0
Gauarab	13.0	-			01.0	-	14.0
Kanchan	15.0	02.0	-	-	06.0	-	23.0
Manther -03	38.0	19.0					57.0
Mehran-89	33.0	41.7				17.0	91.7
Mexipak	36.0	37.5					70.0
Moomal-2002	25.0	11.0					70.0
Punjnad	61.0	04.0				23.0	88.0
Saleem-2000	01.0	01.0	-		02.0	-	04.0
Tandojam-83	25.0	05.0					30.0
Wafaq-2001	13.0	21.0					34.0
Zarlashata	01.0	02.0	02.0			-	05.0
Total	416.0	221.0	32.0	06.0	92.0	66.0	

Table 3. Occurrence of *Fusarium* species in wheat commercial varieties.

Wheat Varieties	*Fusarium* species
AAS-09	*F. proliferatum*
Chakwal-50	*F. proliferatum, F. oxysporum, F. semitectum, F. equiseti*
Punjnad	*F. proliferatum, F. oxysporum, F. semitectum, F. solani, F. culmorum*
Mehran-89	*F. proliferatum, F. oxysporum, F. semitectum, F. equiseti*

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