Vol. XV (1-2), 1978

STUDIES ON THE BLACK POINT DISEASE OF WHEAT

Munir Ahmad, Mukhtar Ahmad and J. H. Mirza*

The fungi isolated from black point affected grains of wheat in Punjab comprised of *Helminthosporium sativum*, *Alternaria tenuis* and small amounts of *Aspergillus* and *Fusarium* species. *H. sativum* and *A. tenuis* alone and in combination increased seedling mortality and incidence of the disease and decreased germination, tillering, earing and number of grains per ear in the four varieties of wheat. There was more incidence of disease when ears at gluming stage were inoculated with the two fungi alone and in combination. The varieties of wheat ranked in order of susceptibility as C273, Chenab-70, Mexipak and Lyallpur-73.

INTRODUCTION

Black point is one of the important diseases of wheat grain which causes heavy reduction in yield and lowers the quality of the produce (Parashar & Chohan 1967). Several species of fungi have been isolated from black point affected grains of wheat (El-Helaly 1947, Kilpatrick, *et al.* 1965). The fungi most frequently associated with the disease are *Alternaria tenuis* and *Helminthosporium sativum* (Machacek and Greaney, 1938: Greaney and Machacek, 1943; Huguelet and Kiesling, 1973). The balck point of wheat was reported for the first time in Pakistan by Fatmi (1948) who isolated *Alternaria* sp. from disease affected grains. In view of over all importance of wheat and losses caused by black point of wheat, studies were conducted to determine the cause and control of this disease.

MATERIALS AND METHODS

Isolations of fungi were made from diseased wheat grains collected from Faisalabad, Gujrat and Muzaffargarh districts on potato-dextrose agar medium. The wheat grains were disinfested with 0.1% mercuric chloride solution for 1-2 minutes and rinsed twice in sterilized water before planting. Stock cultures of the identified fungi were maintained on basal and Richard's agar media.

*Department of Plant Pathology, University of Agriculture, Faisalabad.

Pathogenicity of two representative cultures of *H. sativum* and *A. tenuis* was studied on four varieties of wheat viz; Lyallpur-73, Chenab-70, Mexipak (white) and C-273 in pots. Soil was disinfested with formaldehyde solution at the rate of 1.5 lbs per cubic foot of soil and covered with polythene sheet for 3 days and then exposed to air for 3 days before filling the pots. There were twenty one pots for each variety and eight seeds were sown in each pot. For each variety there were 7 treatments. In the first three treatments the seeds were infested with *H. sativum* and *A. tenuis* separately and in combination. In the next three treatments the seeds were sown as such and the ears were inoculated at the gluming stage with the two fungi separately and in combination. In the last treatment the seeds were sown as such which served as a check.

RESULTS AND DISCUSSION

The fungi isolated from black point affected grains of wheat comprised mostly of *H. sativum A. tenuis* and in small amounts *Aspergillus* and *Fusarium* species (Table 1). The results are in agreement with those of Kilpatrick, *et al.* (1965) and Fatmi (1948). Since *Aspergillus* and *Fusarium* species were isolated in negligible amounts, they were not included in further studies.

Table 1. *Prevalence of fungi isolated from black pointed grains of wheat collected from three localities.*

Localities	Number of isolates out of 390	Prevalence of fungi isolated (Percentage)			
		H. sativum	*A. tenuis*	*Aspergillus* Spp.	*Fusarium* Spp.
Faisalabad	220	58	37	3	2
Gujrat	80	54	42	2	2
Muzaffargarh	90	49	48	2	1
Average	130	53.67	42.33	2.33	1.67

The pathogenicity of *H. sativum* and *A. tenuis* alone and in combination was studies in the four different varieties of wheat viz; C–273, Lyallpur–73, Chenab-70 and Mexipak. The effect of fungi on the incidence of disease when seed was infested and when ears were inoculated is given in Table 2. *Helminthosporium sativum* was found to be more deleterious than *A. tenuis*. The varieties which produced large grains were more susceptible to the incidence of disease because the large kernels forced open their glumes thus providing aecess to the spores of pathogenic fungi as also noted by

El-Helaly (1947). There was more incidence of disease when ears were sprayed as compared to the crop from seed infested with *H. sativum* and *A. tenuis* alone and in combination as also found by Machacek and Greaney (1938), Greaney and Machacek (1943) and El-Helaly (1947).

Table 2. *Effect of black point fungi on the incidence of disease (percentage) in four varieties of wheat.*

Fungi used for infesting seed and ear	Lyallpur–73		Chenab–70		Maxipak		C–273	
	Seed infested	Ear infested	Seed infested	Ear infested	Seed infested	Ear infested	Seed infested	Ear infested
Helminthosporium sativum	7.06	30.28	7.62	31.41	7.13	30.69	10.12	35.82
Alternaria tenuis	3.55	28.03	4.00	28.48	3.62	28.30	7.46	31.66
Mixture of fungi	7.18	31.54	9.08	31.99	7.77	31.74	10.50	36.27
Disinfested seed (check)	2.75	3.52	2.98	3.10	3.22	3.54	4.83	4.48
Average	5.14	23.34	5.92	23.74	5.45	23.57	8.23	27.06

	Mixture of Fungi	H. sativum	A. tenuis	Disinfested seed (check)
Seed infested	17.17	17.00	10.50	9.33
Ear infested	60.08	57.83	51.91	6.38

	C-273	Chenab–70	Maxipak	Lyallpur–73
Seed infested	15.33	13.92	12.92	11.83
Ear infested	50.66	50.25	50.08	25.41

Germination and seedling mortality.

The germination of wheat seed in four varieties of wheat was reduced significantly when the black point fungi were used separately and in combination. On an average mixture of fungi and *H. sativum* separately were significantly more harmful than *A. tenuis*.

Infestation with black point fungi separately and in combination increased the seedling mortality significantly. On an average mixture of fungi and *H. sativum* alone were more harmful than *A. tenuis* (Table 3).

Table 3. *Effect of black point fungi on seed germination and seedling mortality in four varieties of wheat (Percentage).*

Fungi infesting the seed	Lyallpur-73		Chenab-70		Maxipak		C-273	
	Germination	Seedling mortality	Germination	Seedling mortality	Germination	Seedling mortality	Germination	Seedling mortality
Helminthosporium sativum	66.69	18.45	60.65	18.75	62.50	26.50	79.83	17.65
Alternaria tenuis	75.00	11.1	79.11	10.53	79.11	21.05	75.00	5.55
Mixture of Fungi	54.17	23.08	49.98	25.00	50.02	25.00	54.17	23.08
Disinfested seed (check)	87.50	4.76	83.83	4.76	83.83	—	87.50	9.52
Average	70.83	14.42	69.77	14.76	68.74	18.18	73.88	13.95

	Check	A. tenuis	H. sativum	Mixture of Fungi
Germination	6.83	6.17	5.33	4.17

Tillering and earing.

Infestation with black point fungi separately and in combination reduced the tillering and earing of four varieties of wheat. Mixture of fungi and *H. sativum* separately were more harmful than *A. tenuis* (Table 4).

Number and weight of grain.

Infestation with black point fungi separately and in combination reduced the number and weight of grains significantly. Mixture of fungi and *H. sativum* alone were more deleterious than *A. tenuis* (Tadle 5).

Table 4. *Effect of black point fungi on tillering and earing in four varieties of wheat (average per plant).*

Fungi infesting the seed	Lyallpur–73		Chenab–70		Maxipak		C–273	
	Tiller-ing	Ear-ing	Tiller-ing	Ear-ing	Tiller-ing	Ear-ing	Tiller-ing	Ear-ing
Helminthosporium sativum	3.92	3.92	3.70	3.90	3.44	3.56	2.86	2.56
Alternaria tenuis	5.87	4.83	4.71	4.50	4.36	4.45	3.64	3.18
Mixture of Fungi	3.44	3.44	3.88	3.75	3.50	3.38	2.50	2.38
Disinfested seed	6.26	5.63	5.94	5.63	4.68	5.47	3.65	3.65
Average	4.87	4.47	4.56	4.44	4.25	4.22	3.16	2.94

	Disinfested seed	A. tenuis	H. sativum	Mixture of Fungi
Tillering	32.00	22.50	11.25	9.08
Earing	29.91	18.41	11.33	9.00

	Lyallpur–73	Chenab–70	Maxipak	C–273
Tillering	24.25	19.08	17.92	13.58
Earing	21.58	18.50	17.67	10.92

Table 5. *Effect of black point fungi on number of grains and weight of 500 grains in the four varieties of wheat (Average per five ears) (weight in grams).*

	Lyallpur–73		Chenab–70		Maxipak		C–273	
Fungi infesting seed	No. of grains per 5 ears	Weight of 500 grains	No. of grains per 5 ears	Weight of 500 grains	No. of grains per 5 ears	Weight of 500 grains	No. of grains per 5 ears	Weight of 500 grains
Helminthosporium sativum	254.33	14.16	247.67	16.00	240.67	16.05	138.33	17.23
Alternaria tenuis	283.33	17.00	276.34	19.49	273.33	19.34	152.00	18.75
Mixture of Fungi	231.33	12.37	227.33	16.07	223.00	15.00	133.34	16.51
Disinfested seed	324.00	18.45	321.33	22.80	337.00	20.76	172.33	25.76
Average	272.99	15.47	268.16	18.59	265.75	17.79	149.00	19.67

	Disinfested seed	A. tenuis	H. sativum	Mixture of Fungi
Number of grains per 5 ears	286.17	246.00	220.08	203.75
Weight of 500 grains	22.86	20.01	17.86	16.01
	Lyallpur–73	Chenab–70	Maxipak	C–273
Number of grains per 5 ears	273.08	268.17	265.75	149.00
	C–273	Chenab–70	Maxipak	Lyallpur–73
Weight of 500 grains	21.17	20.34	18.54	16.68

LITERATURE CITED.

El–Helaly, A.C. 1947. The black point disease of wheat. Phytopath. 37: 773–76.

Fatmi, A.S. 1948. Studies on Root rot, Foot rot and Black point disease of wheat. Abst. Proc. Ist. Sci. Conf. Pakistan 19.

Greaney, F.J. and J E. Machacek. 1943. Prevalence of *Helminthosporium sativum* in wheat and barley in Canada. (Abst). Phytopath. 33:4.

Huguelet, J.E. and R.L. Kiesling 1973. Influence of inoculum composition on black point disease of wheat. Phytopath. 63 : 1220–1225.

Kilpatrick, R.A., I.M. Atbin, O.G. Merble, and C. D. Mobbs. 1965. Fungi and cultural filtrates in relation to black point disease of wheat. Phytopath 55 : 1064.

Machacek, J.E. and F. J. Greaney. 1938. The black point or "Kernel smudge" disease of cereals. Canadian Jour. Res. 16: 84-113.

Parashar, R.D. and J.S. Chohan. 1967. Effect of black point disease of wheat on seed germination under lab. and field conditions and on yield. Jour. Res. Ludhiana. 4(1): 73-75. (Rev. Appl. Mycol. 47:29).