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Effect of Black Pointed Seed in Seed Sample on Leaf Spot Severity and Grain Infection of Wheat in the Field

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Abstract: Seed samples having different levels of black pointed seed were used in this study. Lowest leaf spot severity (3.36) was found in plots where best seed was sown in the field. Increased number of black pointed seed in the seed sample resulted in formation of higher number of seeds having black point infection in the field. Highest number (82.13 %) of grade-0 (apparently healthy) seeds were obtained from the plots where best seed was used. Formation of black pointed free grain in the field did not differ significantly up to seed sample containing 10 % black pointed seed. Laboratory test revealed that seeds of grade-5 yielded 74.55 % higher incidence of *Bipolaris sorokiniana* over seeds of grade-0. Incidence of *Fusarium* also increased with increase in black point infection but incidence of *Alternaria tenuis* and *Curvularia lunata* did not show any specific relation with severity of black point infection in grain. Higher incidence of *B. sorokiniana* was yielded from the embryo end of both seeds of grade-0 (25.30 %) and grade-1 (2.50 %) than the endosperm.

Key words: Wheat, black point, seed sample, leaf spot, seed grade, *Bipolaris sorokiniana*

Introduction

Wheat production in Bangladesh is thwarted seriously by seed borne disease, especially due to black point. The occurrence of the disease is also world wide (Mathur and Cunfer, 1993). Bangladesh Agricultural Development Corporation (BADC) has been facing serious problem in producing and distributing wheat seeds due to discoloration of the grains as affected by black point pathogens (Fakir, 1988) and the organization has to reject considerable amount of seeds every year inflicting appreciable economic loss.

The fungi that cause black point are generally considered to be highly seed transmitted and posses a potential pathogenic threat to the subsequent crop production. A highly significant correlation has been found between the rate of disease development in the field and infection percentage of *Bipolaris sorokiniana* in the seed (Bazlur Rashid and Fakir, 1998). Leaf spot/leaf blight development is a usual consequence of the seed to plant to seed transmission of *B. sorokiniana* under field conditions (Bazlur-Rashid, 1996). The present study was, therefore, designed to determine the effect of black pointed on severity of leaf spot and grain infection of wheat in the field.

Materials and Methods

Grading of black pointed seeds: Seed samples of wheat cv. Kanchan were collected from BADC, Modhupur, Mymensingh and categorized into seven grades viz. (I) best seed (free from black point) sample (ii) sample containing 4 % black pointed seed (iii) sample containing 7 % black pointed seed (iv) sample containing 10 % black pointed seed (v) sample containing 14 % black pointed seed (vi) sample containing 21 % black pointed seed and (vii) sample containing 28 % black pointed seed. The best seeds were treated with Vitavax-200 (0.4 % of seed weight) for making free from black point pathogens. Each grade of seed samples was treated as treatment in this experiment.

Field study: The experiment was laid out following randomized complete block design (RCBD) having three replications for each treatment. Each unit plot size was 10 m^2 having spacing of 22 cm between the rows and 1 m between blocks and also between plots. The field was fertilized as per recommended dose of BARC (1997). Cowdung was applied @ 10 t ha^{-1} during land preparation. Seeds for each plot under each treatment were sown at the rate of 120kg/ha. Weeding and irrigation were done twice. Leaf spot severity was recorded at flowering, milking and hard dough stages following the method as used by Hossain and Azad (1992). The randomly selected 27 plants/plot (3 from each row) were tagged for rating the disease severity and mean value were determined to get rating score of the material of each treatment. The crop was harvested and grading of harvested seeds was done following 0-5 rating scale of CIMMYT (Gilchrist, 1985).

Laboratory study: The seeds of different grades were then tested following Blotter method (ISTA, 1996). Incidence of *Bipolaris sorokiniana* from dissected embryo and endosperm were also tested following blotter method. Seeds of grade-0 and grade-1 were selected under this test. Two hundred selected seeds from each grade were washed under running tap water for one hour. The seeds were then dissected aseptically with the help of a sharp knife into two parts, embryo and endosperm. The seed components were then tested following Blotter method.

Results and Discussion

The disease severity in all the plots under different treatments was increased with the increase in age of the plants (Table 1). The treatments varied significantly from one to another in respect of leaf spot severity at flowering and soft dough stages. The disease severity at flowering stage for all the treatments ranged from 1.58 to 1.96, where the lowest and the highest counts were made in plots of T_1 and T_7, respectively. The treatments from T_1 to T_4 showed statistically similar results on leaf spot severity. In case of soft dough stage, the minimum (2.29) and the maximum (3.08) leaf spot severity were observed in treatments T_1 and T_7, respectively. Though the treatments did not show any significant influence on leaf spot severity at hard dough stage, but the severity of disease ranged from 3.36 to 4.16, while the highest value was recorded in T_7 and the lowest value was in plots of T_1. Higher level of black pointed seed in the seed sample resulted higher disease (leaf spot) incidence in the field. This is in accord with the findings of Bazlur Rashid and Fakir (1998). They found a highly significant correlation between rate of disease development in the field and seed infection percentage by *Bipolaris sorokiniana*. The leaf spot severity was

Table 1: Effect of different levels of black pointed seed on the prevalence of leaf spot of wheat cv. Kanchan in different growth stages in the field

Treatment	Disease severity (0–5 scale)								
	Growth stage								
	Flowering stage			Soft dough stage			Hard dough stage		
	Flag leaf	Penultimate leaf	Mean	Flag leaf	Penultimate leaf	Mean	Flag leaf	Penultimate leaf	Mean
T_1	1.12	2.04	1.58	1.54	3.04	2.29	2.60	4.12	3.36
T_2	1.14	2.13	1.64	1.77	3.15	2.45	2.61	4.17	3.39
T_3	1.17	2.29	1.73	1.85	3.31	2.58	2.97	4.32	3.65
T_4	1.15	2.27	1.72	1.80	3.49	2.65	2.94	4.50	3.72
T_5	1.32	2.45	1.88	1.91	3.60	2.76	3.11	4.74	3.93
T_6	1.32	2.46	1.89	1.99	3.76	2.88	3.27	4.84	4.06
T_7	1.42	2.50	1.96	2.03	4.12	3.08	3.33	4.99	4.16
LSD (P = 0.05)	0.148	0.281	0.217	0.286	0.548	0.556	NS	NS	NS

NS = Non significant
T_1 = best sample of seed treated with Vitavax (0.4%)
T_2 = seed sample contained 4 % black pointed seed
T_3 = seed sample contained 7 % black pointed seed
T_4 = seed sample contained 10 % black pointed seed
T_5 = seed sample contained 14 % black pointed seed
T_6 = seed sample contained 21 % black pointed seed
T_7 = seed sample contained 28% black pointed seed

Table 2: Effect of different levels of black pointed seed on the formation of different grades of seeds (0-5 grade)

Treatments	% Grains under different grades					
	0	1	2	3	4	5
T_1	82.13	10.53	1.63	1.54	1.27	2.90
T_2	80.40	9.87	2.93	1.87	1.70	3.23
T_3	80.20	10.53	3.00	1.93	1.77	2.57
T_4	78.00	10.86	3.17	1.83	2.53	3.60
T_5	75.00	13.90	2.60	1.77	2.90	3.83
T_6	74.07	13.57	2.83	1.87	2.90	4.76
T_7	74.00	12.63	2.10	2.50	2.40	6.37
LSD (P=0.05)	4.765	NS	0.971	NS	NS	2.683

NS = Non significant
T_1 = best sample of seed treated with Vitavax (0.4%)
T_2 = seed sample contained 4 % black pointed seed
T_3 = seed sample contained 7 % black pointed seed
T_4 = seed sample contained 10 % black pointed seed
T_5 = seed sample contained 14 % black pointed seed
T_6 = seed sample contained 21 % black pointed seed
T_7 = seed sample contained 28% black pointed seed
Grade-0 = free from infection
Grade-1 = only embryo blackish
Grade-2 = embryo and its adjacent area slightly infected
Grade-3 = embryo and less than ¼ of grains are discoloured
Grade-4 = embryo and ½ of grains are infected
Grade-5 = grains are shriveled, almost completely or more than ½ of grains discoloured

Table 3: Incidence of seed borne fungi from seeds of different grades (0-5)

Seed grade	% Seed borne fungi			
	Bipolaris sorokiniana	*Alternaria tenuis*	*Fusarium* spp	*Curvularia lunata*
0	55.00	11.00	1.00	3.50
1	68.50 (24.55)	15.50	6.50	22.50
2	82.00 (49.09)	9.50	21.00	9.00
3	92.50 (68.18)	12.50	31.50	7.00
4	84.50 (53.63)	19.00	32.00	2.00
5	96.00 (74.55)	20.00	12.50	1.50

( ) Data in parentheses indicate % increase over grade-0
Grade-0 = free from infection (apparently healthy)
Grade-1 = only embryo blackish
Grade-2 = embryo and its adjacent area slightly infected
Grade-3 = embryo and less than ¼ of grains are discoloured
Grade-4 = embryo and ½ of grains are infected and
Grade-5 = grains are shrivelled, almost completely discoloured or more than ½ of the grains discoloured

found to increase at a significantly higher rate as they grew older and maximum infection severity was attained at hard dough stage. Nema and Joshi (1974) reported that age was one of the important factors influencing disease intensity and susceptibility of wheat plant to *H. satívum*. Hossain and Azad (1992) reported that higher age of crop plant resulted in higher incidence of leaf spot (*B. sorokíníana*). Temperature plays also an important role in disease incidence. Temperature range, 25-28 °C is favorable for this disease epidemy. In Bangladesh 25-28 °C normally presents in March, when wheat plant turn from soft dough to hard dough stage. Therefore, maximum leaf blight disease incidence occurs at that time.

Seed samples having different levels of black pointed seed were found to show significant effects on formation of seeds of three different grades viz. grade-0, grade-2 and grade-5, but did not affect significantly on the formation of grade-1, grade-2 and grade-4 grains (Table 2). Highest number of grade-0 (free from infection i.e. apparently healthy) seeds (82.13 %) was found, where the best seed (T_1) was sown, while the lowest number (74.00 %) was recorded from the plots of T_7. The treatments from T_1 to T_4 showed statistically similar effect on formation of healthy looking grains. In case of grade-2 seeds the lowest and the highest counts were made in T_1 and T_4, respectively. The minimum (1.54 %) and maximum (2.5 %) numbers of grade-3 seed were found in plots of T_1 and T_7, respectively. Highest number of grade-4 seeds (2.9%) were found from T_5 and T_6 which was followed by T_4 (2.53 %) and T_7 (2.40 %), while the lowest number (1.27 %) was recorded in T_1. Formations of grade-5 seeds ranged from 2.57 to 6.37%, where the highest (6.37 %) and the lowest number (2.57%) were counted in plots of T_7 and T_3, respectively. The results of the present works clearly pointed out that higher number of black pointed seed in seed sample incited more disease to the plant in the field resulting of higher number of seeds having black point infection which is supported by Bazlur Rashid (1996) and Bazlur Rashid and Fakir (1998). Hossain *et al.* (1998) reported that leaf infection at flowering and milk ripening stages has direct effect on the reduction of formation of healthy grains with the increase in number of black pointed as well as discoloured grains. Nice (1999) also found a strong relationship of leaf blight intensity with grain infection.

Seed borne *B. sorokíníana* was lowest (55.00 %) in seeds of grade-0, while the highest (96.0 %) was in seeds of grade-5 (Table 3). Seeds of grade-5 showed 74.55 % higher incidence

Table 4: Seed borne fungi yielded from detached embryo and endosperm of grade-0 and grade-1 seed

Seed grade	Parts of seed	*Bipolaris sorokiniana*	*Alternaria tenuis*	*Fusarium* spp.	*Curvularia lunata*
0	Embryo	52.00 (25.30 %)*	4.50	8.50	2.50
	Endosperm	41.50	7.00	2.50	1.50
1	Embryo	58.50 (3.41 %)	10.00	3.00	14.00
	Endosperm	56.50	22.00	3.00	17.00

* Data in parentheses indicate increase over endosperm
Grade-0 = free from infection (apparently healthy)
Grade-1 = only embryo blackish

of *B. sorokiniana* over grade-0. *Fusarium* spp. was also increased with the increase in severity of black point infection ranging from 1.00 to 32.00 % among all grades, where the highest and lowest results were found in seeds of grade-4 and grade-0, respectively. Incidence of *Alternaria tenuis* and *Curvularia lunata* was not found to increase with the increase in severity of black point infection. *A. tenuis* was the lowest (9.50) in seeds of grade-2 and highest (20.00 %) in seeds of grade-5. Highest (22.5 %) *Curvularia lunata* was in seeds of grade-1 and lowest (1.5 %) in seeds of grade-5. Increased incidence of seed borne *B. sorokiniana* was observed with the increase in severity of black point infection, which is in accordance with the observations of Rossi *et al.* (1991). They found a positive relationship between *Cochliobolus sativus* and intensity of seed discolouration on cultivar Castello, but for the remaining fungi, a clear relationship with the disease was not established. This may be the indication of role played by the pathogen for causing black point infection and is supported by Saari and Prescott (1986). Zhang *et al.* (1990) stated that *Alternaria tenuis* was not an important pathogen of black point diseases unless associated with other fungi.

Detached embryo and endosperm of grade-0 and grade-1 seeds were evaluated for the occurrence of black point fungi (Table 4). Embryo and endosperm of grade-0 seeds yielded *B. sorokiniana* by 52.00 % and 41.50 %, respectively, i.e. embryo yielded 25.30 % higher *B. sorokiniana* over endosperm. The occurrence of *B. sorokiniana* from the embryo and endosperm of grade-1 grains were 58.50 % and 56.50 %, respectively which means 3.41 % higher incidence of *B. sorokiniana* by embryo. *Alternaria tenuis* was higher with endosperm than embryo. The seed borne *Fusarium* spp. and *Curvularia lunata* did not show any pattern of their incidence. The incidence of black point infection starts from embryonal end and extend towards endosperm (Adlakha and Joshi, 1974; Rana and Gupta, 1982). As the infection starts initially from the embryo, therefore, higher incidence of *B. sorokiniana* might be augmented from the embryo rather than endosperm. It is revealed that the seed samples having lower black pointed seed might result in leaf spot severity and grain infection in wheat.

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