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RDS Yadav

Department of Genetics and Plant Breeding, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (UP), India

Anil Kumar

Department of Genetics and Plant Breeding, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (UP), India

Vineet Dheer

Department of Agronomy, C.S.A. University of Agriculture and Technology, Kanpur (UP), India

Purushottam

Department of Genetics and Plant Breeding, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (UP), India

RK Singh

Department of Genetics and Plant Breeding, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (UP), India

RM Tripathi

Department of Genetics and Plant Breeding, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (UP), India

Corresponding Author:**Vineet Dheer**

Department of Agronomy, C.S.A. University of Agriculture and Technology, Kanpur (UP), India

Effect of black point on seed quality in wheat (*Triticum aestivum* L.)

RDS Yadav, Anil Kumar, Vineet Dheer, Purushottam, RK Singh and RM Tripathi

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Abstract

Black point caused mainly by *Bipolaris sorokiniana*, *Alternaria alternata*, *Cladosporium cladosporioides*, *Curvularia lunata* and *Fusarium* spp. is now becoming a serious concern in reducing quality and economic value of wheat. Eleven promising varieties namely DBW 17, HD 2967, K 7903, NW 1012, NW1014, NW 1067, NW 2036, NW 4018, NW 5054, PBW 154 and PBW 550 of wheat were therefore undertaken to study the effect of black point on various seed quality parameters viz., seed germination, root length, shoot length, seedling length, vigour index and 1000 seed weight. The black point complex disease adversely affected the seed quality parameters invariably to wheat varieties. The vigour index was appeared as most responsive seed quality parameter to black point complex disease and followed to seedling length, root length, shoot length, germination and test weight in wheat. The seed growers are thus advised to follow proper seed treatment to mitigate the problems of such seed borne diseases during the quality seed production in wheat.

Keywords: Black point, germination, vigour index, test weight, wheat

Introduction

Wheat, being staple food crop, is backbone of national food security of India. It is being cultivated in most part of the country. Wheat output estimated at a record 106.21 million tonnes in 2019-20 in comparison to 103.60 million tonnes in the previous year owing to increased acreage (33.61 million hectares i.e., 3.68 million hectares more than previous year) and better soil moisture because of 10 per cent more cumulative rainfall than the Long Period Average (grainmart.in). It is infested by a number of seed borne diseases. Out of which the Black point (Bolley, 1913) [2] being caused by a number of pathogens viz., *Bipolaris sorokiniana*, *Alternaria alternata*, *Cladosporium cladosporioides*, *Curvularia lunata*, *Fusarium* spp. (Dastur, 1932; Huguelet and Kiesling, 1973; Adlakha and Joshi, 1974) [4, 7, 1] is realized as a complex disease which generally concerned in reducing its grain quality and economic value (Malaker *et al.*, 2009; Disalov *et al.*, 2018) [10, 5]. The disease often causes blackening and/or discoloration around the embryo region of kernel. The embryo is the core heart of the seed. Quality seed, being critical input, is played a key role to enhance the production and productivity considerably. The study on effect of black point complex disease on quality seed aspect in wheat is meager (Ozer, 2005) [12]. The present investigation was therefore taken up to determine the nature and extent on the effect of black point complex disease on important seed quality parameters in eleven high yielding varieties which were under seed chain in wheat seed production.

Materials & Methods

The present investigation was conducted accommodating eleven high yielding varieties viz., DBW 17, HD 2967, K 7903, NW 1012, NW 1014, NW 1067, NW 2036, NW 4018, NW 5054, PBW 154 and PBW 550 during the course of their quality seed production. Ideal seed plot of each variety was maintained following standard packages of practices. Normal (Healthy) and black point disease infested seed were randomly collected from respective seed lot of each variety and also verified under lab condition for their healthiness and black point infestation according to Gilchrist (1985) [6]. One thousand seed with thrice replicates from already collected healthy and infested seed lot were again randomly separated, weighed and averaged

to record the test weight. These thrice replicated seed were thoroughly mixed in Boerner type divider to ensure homogeneity. Out of these, 50 seed were placed on moist blotter paper in 4 replications and placed in BOD incubator at 22 ± 1 °C to record the germination, root length, shoot length and seedling length as per ISTA Rules (1999) [8]. Seedling vigour index was computed as Germination (%) x Seedling length (cm). Data were analyzed statistically.

Results & Discussion

Effects of black point disease on seed germination, root length and shoot length are presented in table 1. The maximum germination (93.73%) was observed in healthy seed of HD 2967 whereas the lowest germination (82.12%) was depicted

in NW 1067. The loss in germination was ranged from 3.59 per cent (PBW 550) to 9.59 per cent (NW 1067). The germination is an important attribute of quality seed. If the seed lot does not meet the minimum standard of germination, the seed lot is not being treated under quality seed category. As per Indian Minimum Seed Certification Standard, the minimum seed germination standard of wheat seed is 85 per cent. If the germination percentage in any seed of wheat is less than 85 percent, the said seed will not be considered as seed. As such most of the varieties showed the germination percentage less than 85 per cent in infected seed. Thus, the black point disease adversely affected to seed germination being one of the most important seed quality traits.

Table 1: Effects of black point disease on germination, root length and shoot length in wheat varieties.

Variety	Germination (%)			Root length (cm)			Shoot length (cm)		
	Healthy seed	Infected seed	%age loss	Healthy seed	Infected seed	%age loss	Healthy seed	Infected seed	%age loss
PBW-154	90.52	83.61	7.63	11.47	10.17	11.33	9.75	9.09	6.77
NW-2036	90.86	84.24	7.29	11.77	10.56	10.28	11.14	10.04	9.87
NW-4018	92.35	84.21	8.81	12.01	10.85	9.66	10.25	9.20	10.24
NW-5054	90.57	82.78	8.60	12.21	10.83	11.30	10.07	9.14	9.24
NW-1067	90.83	82.12	9.59	12.50	11.48	8.16	10.80	9.67	10.46
DBW-17	92.38	84.86	8.14	12.39	10.97	11.46	10.35	9.79	5.41
PBW-550	91.71	88.42	3.59	12.49	11.02	11.77	9.52	8.45	11.24
HD-2967	93.73	89.09	4.95	12.11	10.87	10.24	10.30	9.22	10.49
K-7903	90.17	83.88	6.98	12.61	12.05	4.44	10.21	9.68	5.19
NW-1014	93.57	88.30	5.63	12.09	11.12	8.02	9.93	9.43	5.04
NW-1012	91.42	84.01	8.10	10.75	9.51	11.53	9.96	9.19	7.73
CD at 5%	1.80	2.17	2.53	1.02	1.53	3.12	0.68	0.68	3.04

The varieties PBW 154, NW 2036, NW 4018, NW 5054, NW 1067, DBW 17, K 7903 and NW 1012 showed the germination percentage less than the Indian Minimum Seed Certification Standard. Thus, these varieties were seemed to be susceptible to black point complex disease in reference to seed germination. The maximum percentage loss in root

length was recorded in PBW 550 (11.77%) followed by DBW 17 (11.46%). The minimum loss (4.44%) in root length was appeared in K 7903 whereas the maximum loss in shoot length was again observed in PBW 550 (11.24%) and its minimum loss was in NW 1014 (5.04%).

Table 2: Effects of black point disease on seedling length, vigour index and 1000 seed weight in wheat varieties.

Variety	Seedling length (cm)			Vigour index			1000 seed weight (g)		
	Healthy seed	Infected seed	%age loss	Healthy seed	Infected seed	%age loss	Healthy seed	Infected seed	%age loss
PBW-154	21.01	19.70	6.23	1901.82	1645.34	13.47	44.67	41.67	6.72
NW-2036	22.91	20.38	11.04	2081.60	1716.81	17.52	41.67	39.67	4.80
NW-4018	22.30	20.10	9.87	2059.40	1692.62	17.81	41.00	38.00	7.32
NW-5054	22.29	20.00	10.27	2018.80	1655.60	17.99	40.33	37.67	6.60
NW-1067	22.99	20.18	12.22	2088.18	1657.18	19.20	44.33	41.67	6.00
DBW-17	22.77	20.88	8.30	2103.49	1771.87	15.77	43.02	41.00	4.65
PBW-550	22.03	19.50	11.48	2020.37	1724.19	14.66	43.67	40.33	7.65
HD-2967	22.43	20.12	10.30	2102.36	1792.49	14.74	41.33	38.67	6.44
PBW-550	22.32	20.10	9.95	2046.97	1777.24	13.18	41.33	39.33	4.84
K-7903	22.85	21.75	10.56	2060.38	1824.39	11.45	42.00	40.00	4.76
NW-1014	22.14	20.58	9.93	2071.63	1817.21	12.28	41.67	39.33	5.67
NW-1012	20.74	18.70	9.84	1940.64	1651.21	14.91	42.00	39.67	5.55
NW-5054	21.41	19.53	8.78	1958.59	1640.72	16.23	40.67	38.67	4.92
CD at 5%	0.78	0.68	4.28	94.11	65.24	4.54	0.945	1.34	1.95

Altogether, the maximum seedling length of healthy seed was marked in NW 1067 (22.99 cm) followed by NW 2036 (22.91 cm) and K 7903 (22.85 cm). The percentage of loss in seedling length via infected seed was appeared also in same order of varieties. It revealed the higher severity of the disease on these varieties. The maximum loss in vigour index was recorded in NW 1067 (19.20%) and lowest was in K 7903 (11.45%). Vigour index is multiple of germination percentage and seedling length. The maximum loss in test weight was obtained in PBW 550 (7.65%) closely followed by NW 4018

(7.32%) whereas its minimum was in DBW 17 (4.6%). The results cleared that the seed quality parameters under study were invariably responsive to black point complex disease irrespective of genetic architecture of varieties which is in very close to earlier reports (Conner and Thomas, 1985; Li *et al.*, 2014) [3, 9]. The present findings that the black point complex disease significantly decreased the seed size, germination and inhibited the seedling growth and finally affected the seed vigour of wheat seed, are also in agreement

to earlier reports (Ozer, 2005; Toklu *et al.*, 2008; Mihaela *et al.*, 2013) ^[12, 13, 11].

Conclusion

The black point complex disease adversely affected the seed quality parameters invariably to wheat varieties. The vigour index was appeared as most responsive seed quality parameter to black point complex disease and followed to seedling length, root length, shoot length, germination and test weight in wheat. The seed growers are thus advised to follow proper seed treatment to mitigate the problems of such seed borne diseases during the quality seed production in wheat.

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