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PREVALENCE OF BLACK POINT OF WHEAT UNDER RICE-WHEAT ROTATION IN HARYANA

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ABSTRACT

Wheat seed samples were collected from seed producers of public and private sectors comprising of five districts of Haryana during April-May, 2016. All the samples (100.00%) were found infected with black point with an average infection of 0.99 per cent. The severity of black point was highest in Sirsa district with average infection of 1.165 per cent followed by Kurukshetra (1.365%) and Fatehabad (1.058%) whereas, it was lowest in Yamunanagar (0.401%) followed by Hisar (0.603%). Kurukshetra district recorded highest range of infection (0.25-5.80%) followed by Sirsa (0.20-2.45%) whereas, it was lowest in Fatehabad (0.05-0.30%). The severity of black point was highest in DBW17 with average infection of 2.91 per cent followed by HD 2851 (2.25%). The highest incidence of black point (0.05-5.80%) was found in variety HD 2851 followed by HD 3086 (1.25-3.50%). No variety was found resistant to black point; therefore varieties WH 1142, WH 147 and WH 1105 should be included in seed production programme to minimize black point in wheat.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is considered as king of cereals and contributing 30 per cent of food basket of the country (Kumar *et al.*, 2014). India is the second largest producer of wheat, preceded only by China and major contributor to the agricultural economy of the country. Uttar Pradesh, Madhya Pradesh, Punjab, Rajasthan, Haryana and Bihar are top six states having 88 per cent of the total area under wheat which contributes 92 per cent of the country's production. There are number of factors responsible for lower productivity (3.14 t/ha) of wheat crop as compared to certain developed countries (Germany, 7.52 t/ha; United Kingdom, 7.34 t/ha, Denmark, 7.29 t/ha). Kernels with black point have a distinct dark brown or black discolouration of the whole germ and surrounding area. When the discolouration affects more than half of the kernel or extends into the crease, it is considered smudge (Fernandez and Conner, 2011). Black point is common in all wheat growing regions of the world (Lorenz, 1986) and characterized by a dark discoloration of the embryo sides of the wheat and barley grains (Mak *et al.*, 2006). Diseased kernels are discolored and are black at the ends of the seed. Embryos are often shriveled and brown to black in color. Black point of wheat is a brown or black discoloration at the germ end of the grain and in severe cases extends along the crease of the grains (Williamson, 1997). Black point of wheat is an important disease of wheat grain affecting the marketable price of wheat as well as the flour quality and thus undesirable for the market and food industry (Borker *et al.* 2008). The harvested grain with incidence of black point is downgraded in certain cases (Wang *et al.*, 2003). The disease did not reduce the grain yield, the qualitative appearance of the grain, particularly the colour and luster, are affected and reduced the market price of wheat by 3.71 to 12.49 per cent in 5-50 per cent of the infected seed lots, respectively as compared to healthy seed lots (Solanki *et al.*, 2006). It occurs anytime between grains filling to near harvest. High humidity and frequent rainfall from milk to dough stage, late season irrigation and lodging often trigger infection by the fungi which occur on developing kernels that do not exhibit symptoms (Southwell *et al.,* 1980).

Black point is a serious problem and occurs regularly especially in irrigated areas where *T. aestivum* wheat are predominantly grown. When, seed moisture content exceeds 20 per cent, coupled with the relative humidity above 90 per cent, the amount of black point increases dramatically. The environment had a major impact on the incidence of black point. Low temperature and high rainfall during the period of grain filling resulted in severe kernel discoloration (Wang *et al.*, 2002). Numerous other studies indicated that black point is not associated with any particular fungus but may be a result of abiotic stress conditions such as heavy rain, high humidity, and extremes of temperature during the grain filling period (Conner, 1989; Kumar *et al.*, 2002; Clarke *et al.*, 2004; Sadasivaiah *et al.*, 2004). All over the world, various pathogens have been reported to be associated with black point viz. *Alternaria alternata*, *Drechslera sorokiniana* and species of *Fusarium, Curvularia* and *Cladosporium* besides *Stemphylium, Nigrospora, Penicillium* (Mathur and Cunfer, 1993). Black point is the cause of multiple pathogen. However, *Alternaria alternaria* was revealed as the prime cause of the disease (Patel and Minipara, 2016).

To get black point free wheat for marketing, identification of disease free or less infested areas is of utmost importance. Keeping in view this, the study was carried out to monitor the incidence of black point in rice-wheat districts of Haryana.

MATERIALS AND METHODS

Extensive post-harvest surveys were conducted in five districts *viz*. Yamunanagar, Kurukshetra, Sirsa, Fatehabad and Hisar of Haryana during April-May, 2016 and samples of wheat seed were collected from different seed producers of public as well as private sectors. Out of the working sample, 2000 seeds were drawn randomly and spread on purity board for the analysis of black point incidence (Srivastava *et al.*, 2014; Jakhar and Bhuker, 2015). The seed samples were analyzed through visual observations and dry seed examination method against black point. Per cent infected samples as well as percent infection was calculated as follows:

$$\% \text{ infected samples} = \frac{\text{No. of samples having black seed}}{\text{Total no. of samples}} \times 100$$

$$\% \text{ average infection} = \frac{\text{No. of black point seed in a sample}}{2000} \times 100$$

RESULTS AND DISCUSSION

A total of 167 wheat seed samples were analyzed and all the samples (100.00%) were found infected with black point with an average infection of 0.99 per cent. The severity of black point was highest in Sirsa district with average infection of 1.165 per cent followed by Kurukshetra (1.365%) and Fatehabad (1.058%). The incidence of the disease was lowest in Yamunanagar (0.401%) followed by Hisar (0.603%). During *rabi* 2016, Kurukshetra district recorded high infection/ incidence of black point (range of infection = 0.25-5.80%) followed by Sirsa (0.20-2.45%) whereas, it was low in Fatehabad (range of infection = 0.05-0.30%). Among 26 varieties (Table 2), all the varieties were found infected with black point and severity of black point was highest in DBW17 with average infection of 2.91 per cent followed by HD 2851 (2.25%), HD 3086 (2.19%), KRL 210 (2.00%), WH 1080

Table 1: Districtwise incidence of black point

District	Total no. of samples	Infected samples No.	%	No. of infected seeds	Average infections (%)	Range of infections (%)
Yamunanagar	29	29	100.00	233	0.401	0.10-1.35
Sirsa	35	35	100.00	816	1.165	0.20-2.45
Hisar	29	29	100.00	350	0.603	0.10-1.75
Fatehabad	18	18	100.00	381	1.058	0.05-0.30
Kurukshetra	56	56	100.00	1529	1.365	0.25-5.80
Total	167	167	100.00	3309	0.990	0.05-5.80

Table 2: Varietywise incidence of black point

Variety	Total no. of samples	Infected samples No.	%	No. of infected seeds	Average infections (%)	Range of infections (%)
PBW 550	7	7	100.00	121	0.864	0.15-2.20
DBW 621-50	6	6	100.00	23	0.191	0.10-0.90
DBW17	10	10	100.00	291	2.910	0.55-2.70
DBW71	5	5	100.00	55	0.550	0.25-0.75
DBW88	7	7	100.00	88	0.628	0.15-2.10
DBW90	8	8	100.00	149	0.931	0.55-1.35
WH1105	22	22	100.00	244	0.554	0.10-1.75
WH1124	12	12	100.00	311	1.295	0.60-2.45
WH1142	1	1	100.00	2	0.100	0.10
WH 1080	7	7	100.00	197	1.407	1.20-1.80
HD 2851	20	20	100.00	903	2.257	0.05-5.80
HD 2894	4	4	100.00	72	0.900	0.50-1.15
HD3086	5	5	100.00	219	2.190	1.25-3.50
HD 2967	32	32	100.00	309	0.482	0.05-0.85
HD3059	8	8	100.00	155	0.968	0.35-1.50
HD2329	1	1	100.00	6	0.300	0.30
KRL210	1	1	100.00	40	2.000	2.00
KRL 213	1	1	100.00	20	1.000	1.00
WH711	3	3	100.00	39	0.650	0.55-0.75
WH147	1	1	100.00	2	0.100	0.10
WH283	1	1	100.00	13	0.650	0.65
C306	1	1	100.00	20	1.000	1.00
PBW343	1	1	100.00	3	0.150	0.15
PBW502	1	1	100.00	6	0.300	0.30
Raj3765	1	1	100.00	4	0.200	0.20
Raj3077	1	1	100.00	17	0.850	0.85
Total	167	167	100.00	3309	0.990	0.05-5.80

(1.40%), WH 1124 (1.29%) and C 306 (1.00%). The highest infection/incidence of black point (range of infection = 0.05-5.80%) was found in variety HD 2851, followed by HD 3086 (1.25-3.50%), DBW 17 (0.55-2.70%), WH 1124 (0.60-2.45%), PBW 550 (0.15-2.20%), DBW 88 (0.15-2.10%), WH 1080 (1.20-1.80%) and WH 1105 (0.10-1.75%) whereas, it was low in WH 1142 and WH 147 (0.10% each). The overall range of infection was 0.05-5.80 per cent. It is concluded from the study that varieties WH 1142, WH 147, WH 1105 are less susceptible to black point and Yamunanagar, Hisar and Fatehabad are less infected areas.

The critical period for black point incidence, in presence of *Alternaria alternata* and some other fungi in Argentina, has been reported 30 days after heading and to persist for 14-20 days (Moschini *et al.*, 2006). During this period of time, warm weather (>17°C) and daily relative humidity of 60-85% reportedly increased black point incidence. Interestingly, Mak *et al.* (2006) did not find any fungal or bacterial proteins in black point samples sourced from Queensland, Australia, while they detected high levels of stress-proteins in healthy grains. These researchers concluded that abiotic factors are responsible for black point initiation and that fungi are secondary. High relative humidity, intermittent rains and relatively higher temperature at anthesis might be the reason of high incidence in the other areas. So seed production of WH 1142, WH 147, WH 1105 varieties should be taken in this area to minimize black point in wheat.

REFERENCES

Borkar, S. G., Chaudhary, K. N., Patil, P. D. and Sonawane, R. B. 2008. Distribution and association of fungal pathogens with black point of wheat disease in Maharashtra state. *J. of Pl. Disease Sci.* **3:** 13-16.

Clarke, M. P., Gooding, M. J. and Jones, S. A. 2004. The effects of irrigation, nitrogen fertilizer and grain size on Hagberg falling number, specific weight and black point of winter wheat. *Journal of the Science of Food and Agriculture*. **84:** 227-236.

Fernandez, M. R. and Conner, R. L. 2011. Root and crown rot of wheat. *Prairie Soils Crops J.* **4:** 151-157.

Conner, R. L. 1989. Influence of irrigation and precipitation on incidence of black point in soft white spring wheat. *Canad. J. Pl. Path.* **11:** 388-392.

Lorenz, K. 1986. Effects of black point on grain composition and baking quality of New Zealand wheat. *N. Z. J. Agric. Res.* **29:** 711-718.

Mak, Y., Willowa, R. D., Roberts, T. H., Wrigley, C. V., Sharp, P. J. and Copeland L. 2006. Black point is associated with reduced levels of stress, disease and defence-related proteins in wheat grain. *Molecular Plant Pathology*. **7:** 177-189.

Mathur, S. B., Cunfer, B. 1993. Black Point. In: *Seed-borne Diseases and Seed health testing of wheat*. Copenhagen, Denmark: Danish Government Institute of Seed Pathology for Developing Countries. pp. 13-21.

Moschini, R. C., Sisterna, M. N. and Carmona, M. A. 2006. Modeling of wheat black point incidence based on meteorological variables in the southern Argentinean Pampas region. *Aust. J. Agric. Res.* **57:** 1151-1156

Jakhar, S. S. and Bhuker, A. 2015. Status of black point disease of wheat in Haryana. *Bhartiya Krishi Anushandhan Patrika*. **30:** 65-67.

Kumar, J., Schafer P., Huckelhoven, R., Langen, G., Baltruschat, H., Stein, E., Nagarajan S. and Kogel, K.H. 2002. *Bipolaris sorokiniana*, a cereal pathogen of global concern: Cytological and molecular approaches towards better control. *Molecular Plant Pathology*. **3:** 185-195.

Kumar, B. Dhananjay and Singh B.N. 2014. Evaluation of genetic divergence in wheat (*Triticum aestivum* L.) germplasms. *The Bioscan.* **9(2):** 755-758.

Patel, D. J. and Minipara, D. B. 2016. Assessment of fungi associated with black point disease of wheat and genetic variation amongst the most dominantly isolated fungus. *The Bioscan.* **11(4):** 2105-2110.

Sadasivaiah, R. S., Perkovic, S. M., Pearson, D. C., Postman, B. and Beres, B. L. 2004. Registration of 'AC Andrew' wheat. *Crop Sci.* **44:** 696-697.

Solanki, V. A., Augustine, N. and Patel, A. A. 2006. Impact of black point on wheat trade and its management. *Ind. Phytopath.* **59:** 44-47.

Srivastava, J. P., G.D. Kushwaha and D. N. Shukla, 2014. Black point disease of wheat and its implications on seed quality. *Crop Res.* **47:** 21-23.

Southwell, R. J., Wong, P. T. W. and Brown, J. F. 1980. Resistance of durum wheat cultivars to black point caused by *Alternaria alternata*. *Australian J. Agri. Res.* **31:** 1097-1101.

Wang, H., Fernandez, M. R., Clarke, F. R., DePauw, R. M. and Clarke, J. M. 2002. Effects of foliar fungicides on kernel black point of wheat in southern Saskatchevan. *Canad. J. P1. Path.* **24:** 287-293.

Wang H., Fernandez, M. R., McCaig, T. N., Gan, Y. T., Depauw, R. M. and Clarke, J. M. 2003. Kernel discoloration and downgrading in spring wheat varieties in Western Canada. *Canad. J. P1. Path.* **25:** 350-361.

Williamson P. M. 1997. Black Point of Wheat: *In vitro* production of symptoms, enzymes involved and association with *Alternaria alternata*. *Aust. J. Agric. Res.* **48:** 13-19.