



SYMPTOMATOLOGY OF BLACK POINT INFECTED WHEAT (*Triticum aestivum* L.) SEEDS

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Abstract- Wheat is the most crucial crop cultivated in India. Black point disease of wheat imparts qualitative losses to the growers. Hence, with a view to generate scientific information pertaining to symptomatology of black point disease, the investigation was carried out. The seed samples of popularly cultivated wheat varieties viz., GW 496, GW 366 and Lok- 1 were collected from various districts of Gujarat viz., Anand, Ahmedabad, Kheda and Vadodara. *Alternaria alternata* was found to be frequently isolated pathogen from infected seeds. Critical microscopic observation of black point infected wheat seeds revealed brown to black discoloration on pericarp, ventral crease and brush end regions. Precise stereoscopic observation of vertical section of infected seeds evidenced brown to black stains on endosperm tissues. Moreover, blatant mycelial growth appeared on pericarp tissues. Flour quality was significantly impaired as compared to healthy seeds. The infected seeds found relatively bolder and heavier.

Keywords- Black point, wheat, symptom, discolouration, seed

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Introduction

Wheat (*Triticum aestivum* L.) belongs to family Gramineae. Wheat is infested by various seed-borne diseases. The black point is one of the most important seed-borne disease of wheat which induces qualitative loss. Since the first report of black point of wheat in the United States in 1913, it has been reported in other wheat growing countries [1]. Wheat kernel discolouration is due to fungal invasion and termed as black point [2]. Black point disease of wheat was first time reported in India by Dastur [3]. Incisively, *Alternaria alternata* is considered as prime cause of black point disease [4]. However, other pathogens viz., *Drechslera sorokiniana*, *Fusarium* spp., *Curvularia* spp., *Cladosporium* spp., *Helminthosporium* spp., *Stemphylium* spp., *Phoma* sp. and *Nigrospora* spp. are reported to be associated with the disease [5-7]. The disease causes dark brown to black discolouration around embryo region of wheat seeds [8]. The disease reduces grain quality and its economic value [9]. Black point reduces qualitative appearance of the grain, particularly the colour and luster and reduces the market price of wheat in the range of 3.71 to 12.49 per cent in Gujarat [10]. The infection invariably causes deprivation of seed and grain quality coupled with diminution of nutritive value [11]. As black point disease is comparatively less explored under Gujarat conditions, the present investigation was conducted to generate scientific information.

Materials and Methods

Sample Collection

The experiment was conducted in *in vitro* conditions at B. A. College of Agriculture, Anand Agricultural University, Anand in year 2013. Fresh seed samples, approximately 20 samples of popularly cultivated wheat varieties viz., GW 366, Lok 1 and GW 496 were collected after harvesting season from the farmers' fields of wheat growing areas of Gujarat viz., Anand, Ahmedabad, Kheda, Mehsana and Vadodara. Atleast 20 samples were collected from each of the districts. From the harvested seed lot five primary samples were collected and mixed to have composite samples. Working samples were prepared from composite samples by repeated halving method.

Isolation and Identification of Pathogen

Isolation of pathogen from black point infected seeds was carried out after pre-treating the seeds with 0.5 per cent sodium hypochlorite solution for one min by standard blotter and standard agar plate method. Total 400 seeds from each of the seed samples were assessed. Fungal colonies developed on each of the seeds, after incubation at 25°C for about seven days. The isolated fungi, after purification by single spore isolation or hyphal tip method, were maintained on potato dextrose agar (PDA) at low temperature

(5°C). The fungal cultures were sent to Indian Type Culture Collection (ITCC), IARI, New Delhi. The pathogen was identified as *Alternaria alternata*.

Symptomatology

Infected wheat seeds collected from each of the wheat growing selected pockets were examined visually by means of magnifying lens under artificial light as well as under stereoscopic microscope. Then, symptoms observed on seeds were described accordingly.

Results

Precise observation of infected seeds revealed brownish-black discolouration in scattered manner on various parts of seed. The infected seeds showed brownish-black discoloration prominently restricted to embryonic end region. Furthermore, the embryo of the

seeds appeared quite shriveled. The floury endosperm of the severely infected seeds appeared brownish-black. Conspicuous brownish-black patches could be seen on the pericarp of infected seeds. Moreover, similar types of discolouration appeared on ventral crease and brush end of seeds. Interestingly, observations of pericarp of severely infected seeds under the microscope revealed presence of conspicuous fungal growth in some seeds. Flour colour of infected seeds was dull white in contrast to creamish white of healthy seeds. Surprisingly, infected seeds found bolder and heavier in weight than healthy seeds [Fig-1].

Earlier, similar symptoms such as discolouration on embryo, pericarp, endosperm, brush end and ventral crease tissues, shriveled embryo etc. have been described by various researchers [6,7,12-16].

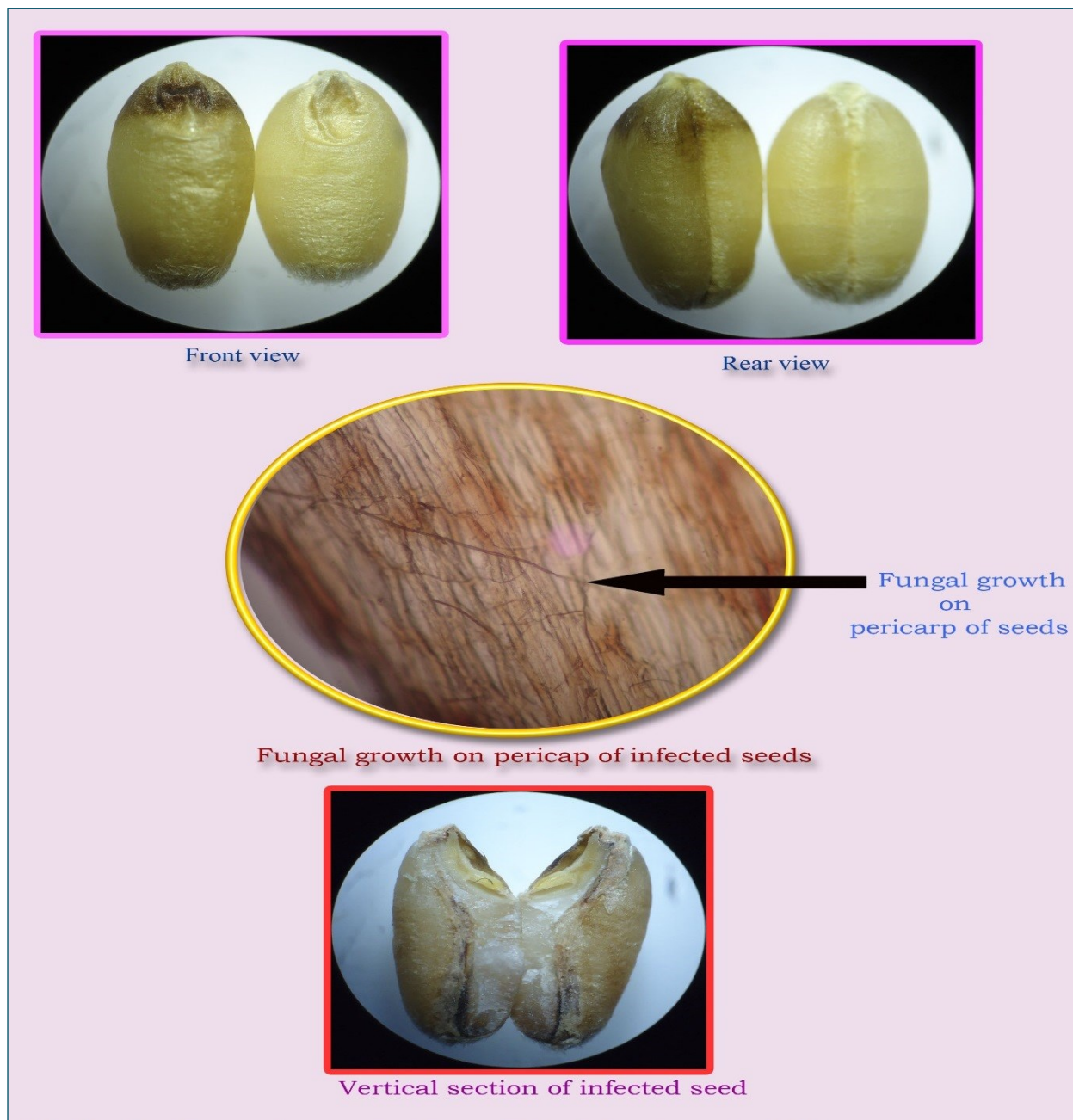


Fig. 1- Symptoms produced by black point disease.

Microscopic Characterization of Pathogen (*Alternaria alternata*)

The fungus produced olivaceous green coloured colony on PDA plates with dark brown to black coloured reverse. Dark brown conidiophores of this isolate appeared simple or branched. Mycelium was septate and pale brown. Yellowish-brown conidia with 3 to 5 transverse and 1 to 2 longitudinal septa were muriform and broader at base than tip portion. Conidial formation was in acropetal succession. The beak of the conidia was short and cylindrical. These characters matched with the characteristics of *Alternaria alternata*

Discussion

Such visible abnormalities of wheat seeds might have been produced partly due to one or more mycotoxins produced by pathogen during the infection. Moreover, congenial temperature and humidity, intermittent rain, during flowering and seed maturation period as well as faulty application of nitrogenous fertilizers might have favoured the growth of pathogen and thereby aggravated symptomatology. Similarly, bold seeds of the spike may partly lead to more open floret during the grain development stage which might have allowed the pathogen to enter in the floret and cause higher infection to bold seeds as compared to normal seeds. In the first place, black point symptoms is produced due to a dense mycelial mat at the embryo [12]. Black point discoloration commences during grain filling stage is due to degradation of the seed coat [17]. Severe kernel discoloration of wheat is due to low temperature and high rainfall during the period of grain filling [9]. Black point infected seeds were heavier than healthy ones [14]. Light to dark brown-black discoloration of embryonic region is predominant symptom of black point disease followed by dark brown to black discoloration at embryonic end of seeds [6]. Black point disease is characterised by brown to black discoloration of embryonic region and endosperm tissues. Furthermore, delayed irrigation practiced to utilise the residual soil moisture facilitates the infection and symptom expression [7].

Conclusion

The disease causes discoloration on various parts of seeds which hits visual quality. Conspicuous brownish-black discoloration mainly at embryonic end and brush end are diagnostic symptom of the disease. It also strikes on endosperm tissues and ventral crease of seeds imparting similar type of discoloration. In extreme conditions, microscopic observations of pericarp tissues evidences typical fungal growth within. Defective agronomical practices coupled with favourable meteorological conditions endorse the pathogenic growth which in turn causes symptoms.

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Conflicts of Interest: None declared.

References

- [1] Watkins J.E. & Prentise L.J. (1997) *Black point disease of wheat*, Neb Guide, Publ. Institute of Agriculture and Natural Resources, Lincoln Extension, University of Nebraska, U.S.A.
- [2] Bolley H.L. (1913) *Wheat: soil troubles and seed deterioration*, North Dakota Agriculture Experiment Station Bulletin, North Dakota, 107.

- [3] Dastur F.J. (1932) *Agriculture Livestock in India*, 2, 275-282.
- [4] Adlakha K.L. & Joshi L.M. (1974) *Indian Phytopathology*, 27, 41-44.
- [5] Hasan K., Abuzer S. & Yunus B. (2009) *Notulae Scientia Biologicae*, 1, 92-96.
- [6] Khulbe D., Srinivas P. & Agarwal V. (2011) *Annals of Plant Protection Science*, 19, 383-387.
- [7] Srivastava J.P., Kushwaha G.D. & Shukla D.N. (2014) *Crop Research*, 4, 21-23.
- [8] Mak Y., Willows R.D., Roberts T.H., Wrigley C.W., Sharp P.J., & Copeland L.E.S. (2006) *Molecular Plant Pathology*, 7(3), 177-189.
- [9] Wang H., Fernandez M.R., Clarke F.R., DePauw R.M. & Clarke J.M. (2002) *Canadian Journal of Plant Pathology*, 24, 287-293.
- [10] Solanki V.A., Augustine N. & Patel A.A. (2006) *Indian Phytopathology*, 59, 44-47.
- [11] Vuckovic J.N., Brkljaca J.S., Bodroza-Solarov M.I., Bagi F.F., Stojšin V.B., Čulafić J.N. & Acimović, M.G. (2012) *Food Feed Research*, 39, 79-88.
- [12] Bhowmik T.P. (1969) *Plant Disease Report*, 53, 77-80.
- [13] Monaco C., Sistema M., Perella A. & Bello G. (2004) *World Journal of Microbiology and Biotechnology*, 20, 285-290.
- [14] Sisterna M.N. & Sarandon S.J. (2005) *Plant Pathology Journal*, 4, 26-28.
- [15] Toklu F., Akgül D., Mehmet B. & Karakoy T. (2008) *Turkish Journal of Agriculture and Forestry*, 32, 267-272.
- [16] Weise M.V. (1987) *Compendium of wheat diseases*, APS Press, St. Paul, MN, USA, 112.
- [17] Williamson P.M. (1997) *Australian Journal of Agriculture Research*, 48, 13-19.