

Effect of Relative Humidity on the Development of Head Blight by *Bipolaris sorokiniana* in Wheat

SHEIKH AFSAR UDDIN¹, K. M. KHALEQUZZAMAN^{2*} AND A. Q. M. BAZLUR RASHID³

¹Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh, Bangladesh,

²Plant Pathology Division, Agricultural Research Station, BARI, Bogra, Bangladesh

³School of Agriculture and Rural Development, Bangladesh Open University, Gazipur, Bangladesh

Received 14 May 2003; received in revised form 18 July 2005; accepted 22 June 2006

ABSTRACT

Effect of exposure to different duration of high humidity (5,10,15,20,25 & 30 days) on the development of head blight caused by *Bipolaris sorokiniana* in wheat was studied *in vitro*. Maximum leaf blight severity of 42.97% and head blight development of 87.53% caused by the pathogen were recorded for the infected plants incubated for a period of 30 days under condition of high humidity. The treatments did not differ significantly with respect to head blight development except the control. Variable effects of the treatments was observed on the grain quality. The highest diseased (black pointed and shriveled) grains of 62.27% were recorded in treatment 6 (30 days exposure) followed by treatment 5 (25 days exposure) with 48.01% diseased grains. There were no significant differences among the other treatments except the check.

Key words: Humidity, head blight, leaf blight, *Bipolaris sorokiniana*, wheat.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is one of the most important grain crops providing nearly 20% of the total world food requirement. It is considered as the second most staple food crop next to rice in Bangladesh. But the yield of wheat is too low in comparison to the world wheat production. There are many factors behind the low yield of wheat in Bangladesh. Among the various constraints threatening wheat cultivation in the country, diseases caused by different pathogens particularly *Bipolaris sorokiniana* syn. *Drechslera sorokiniana* (perfect stage *Cochliobolus sativus*) play a vital role. The pathogen has been reported to create panic among the wheat growers as well as the wheat researchers in the country (Hossain and Azad, 1992). The pathogen is seed borne and seed transmitted in nature (Fakir *et al.*, 1977 and Bazlur Rashid, 1998) and may exist in different parts of the seeds. Head infection by the pathogen is the ultimate result of the disease leaf blight, the most important and serious problem in wheat cultivation in the country (Bazlur Rashid *et al.*, 1987).

The weather conditions particularly relative humidity is one of the most important congenial factors for the development of the disease. The head infection increase the unwanted black pointed, shriveled and infected seeds. In severe cases, the infected head may turn into blight. In 1997-98 growing season the unusual rainfall all over the country in February and March resulted an

* Corresponding author: SO, ARS, BARI, Seujgari, Bogra-5800.

outbreak of the disease (Bazlur Rashid and Fakir, 1998). Therefore, the present work was undertaken to determine the influence of duration of moistened conditions on the head blight development of wheat in vitro.

MATERIALS AND METHODS

The experiment was conducted in the net house of the Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh during Rabi season (2000-2001). For pot preparation in net house, soil was mixed uniformly with decomposed cow dung at the ratio 2:1. The mixed soil was dried in air for three days and treated with 3 % formalin solution for sterilization and covered with polythene. After three days the treated soil was exposed to air for 48 hours in order to remove excess vapour of formalin. Pots were filled up with 5 kg sterilized dried soil. The widely cultivated wheat variety Kanchan was used. The seeds were collected from Bangladesh Agricultural Development Corporation (BADC) of Mymensingh. Nine seeds were sown per pot. After germination of seeds, regular and uniform watering was followed every afternoon up to the end of data collection to maintain adequate moisture.

The isolate of *Bipolaris sorokiniana* was collected from infected seeds on moist blotter and multiplied on PDA. The conidial suspension was prepared to 10^4 conidia/ml following the CIMMYT method (Gilchrist, 1985). When the plants in the pots reached at booting stage, inoculation was done by hand sprayer. The spraying was carried out until the droplets of spore suspension were formed on all parts of the plants. Four replications were maintained for each treatment. The inoculated plants were covered with polythene for 5, 10, 15, 20, 25 and 30 days as treatments viz. T₁, T₂, T₃, T₄, T₅ and T₆, respectively. The control treatment denoted by T₀ received inoculation also with inoculum suspension but were not covered by polythene bag. The induced disease severity was recorded at regular intervals to note the progress of the disease development. The disease severity was assessed by counting the percent leaf area infected and rated by 0-5 scale (Bazlur Rashid *et al.*, 1987). But the development of head blight was specially recorded in 0-3 scale mentioned below as outlined by Bazlur Rashid and Fakir (2000):

<u>Scale</u>	<u>Description</u>
0	= Apparently healthy looking spikes having no disease symptom.
1	= One spikelet in a spike is infected with dark brown discolouration and/or with black powdery masses of conidia on the glumes.
2	= Two spikelets in a spike are infected with the same symptoms and sign as in grade 1.
3	= More than two spikelets in a spike are infected as in grade 1. In severe cases the whole spike may be blighted and the maturing kernels become deformed and discoloured.

The disease index in both the cases was calculated by following the formula as outlined by Singh (1984).

$$\text{Disease index} = \frac{\text{Sum of all disease ratings}}{\text{Total no. of ratings} \times \text{Maximum disease grade}} \times 100$$

The crop was harvested at full ripening stage. The harvested crop was threshed mechanically by hand and the grains were separated as apparently healthy looking and diseased (Black pointed and shriveled). The weather data (Table 3) were collected from Weather yard, Department of Irrigation and Water Management, BAU, Mymensingh. All the recorded data were subjected to statistical analysis and tested according to Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

The induced leaf blight severity recorded and rated has been presented in Figure I. It is revealed that the maximum leaf blight severity was obtained in treatment T₆ (42.97%) and T₅ (39.41%) that

were statistically similar followed by T₄ and T₃ that were again statistically similar. The minimum disease severity of 14.32% was recorded in the control treatment.

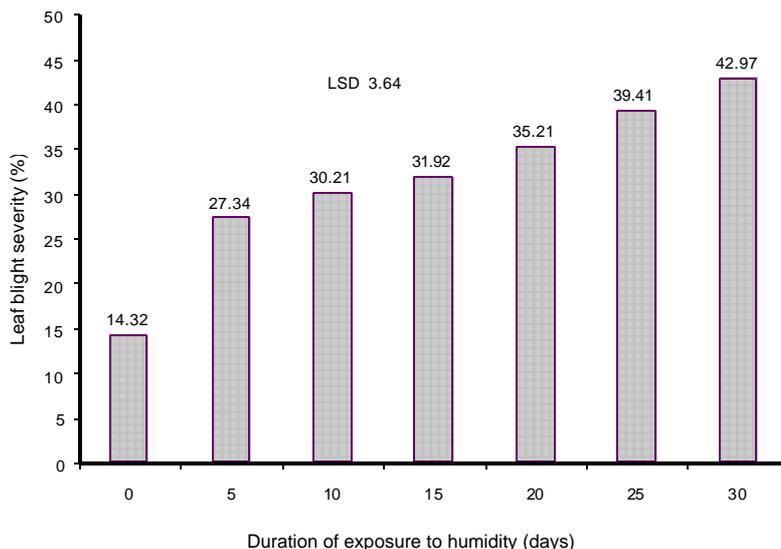


Fig. 1. Leaf blight severity of wheat incited by *Bipolaris sorokiniana* under different duration of exposure to humidity

The results on the wheat head blight severity caused by *Bipolaris sorokiniana* under different length of incubation period of moistened conditions on the subsequent disease development in plants has been presented in Table 1. Maximum head blight severity of 87.53% was recorded in case of T₆ which was followed by all other treatments except control and there were no significant differences among the disease severities. The minimum disease development (19.07%) was recorded in the control treatment (T₀). There was an increasing trend of disease development with the increasing length of incubation period.

Table 1. Wheat head blight caused by *Bipolaris sorokiniana* under different duration of exposure to humidity

Treatment	Head blight severity (%)
T ₀	19.07 b
T ₁	81.82 a
T ₂	82.78 a
T ₃	84.17 a
T ₄	85.07 a
T ₅	86.29 a
T ₆	87.53 a
LSD	6.33

Figure in a column with common letters do not differ significantly at P<0.1 level.

The percentage of apparently healthy looking and diseased (black pointed and shriveled) grains was highly influenced by the duration of humid conditions (Table 2). The maximum percentage of apparently healthy looking grains (91.01) was recorded in the control treatment (T₀) followed by T₁

(68.26 %). There were no significant differences among the healthy looking grains recorded in the treatments T₂ to T₄. The minimum percentage of apparently healthy looking grains was obtained in T₆ (37.73). On the other hand, the maximum of 62.27 % diseased grains were recorded in treatment T₆ followed by 48.01% at T₅. There were no significant differences among the diseased (Black pointed and shriveled) grains recorded in the treatments T₁ to T₄, where the minimum percentage of (8.99%) diseased grains was recorded in the control treatment.

Table 2. Influence of humidity on the percentage of seeds infection by *Bipolaris sorokiniana*

Treatment	Apparently healthy looking grains	Diseased (Black pointed and shriveled) grains
T ₀	91.01 a	8.99 d
T ₁	68.26 b	31.73 c
T ₂	63.69 c	36.31 c
T ₃	63.07 c	36.92 c
T ₄	61.58 c	38.42 c
T ₅	51.99 d	48.01 b
T ₆	37.73 e	62.27 a
LSD	2.29	8.57

Figures in a column with common letters do not differ significantly at P≥0.01 level.

The head blight severity was statistically similar in all treatments except control. The head blight severity was increased significantly with the length of increasing of period of moistened conditions. This finding is in agreement with that of Randhawan and Sharma (1985). The percentage of apparently healthy looking grains was highly influenced by the humid conditions. The development of low quality of seeds such as black pointed and shriveled which were always undesirable for the purpose of seed as well as for consumption. The leaf blight disease results such undesirable low quality wheat grains which is the problem to the growers as well as to the millers.

Table 3. Weather data on monthly average temperature (°c), relative humidity (%), total rainfall (mm) and sunshine (hrs) of the experimental site for the period of November/2000 to March/2001

Month	** Air temperature (°c)			*Humidity (%)	**Rainfall (mm)	*Sunshine (hrs)
	Maximum	Minimum	Average			
November/00	29.70	19.09	24.40	82.37	0.00	237.08
December/00	26.71	13.43	20.07	77.00	0.00	217.30
January/01	24.40	10.88	17.64	76.90	0.00	192.30
February/01	27.31	16.41	21.36	74.71	11.10	169.40
March/01	31.69	18.67	24.88	70.39	15.40	214.80

*= Daily total, **= Daily average

However, present finding confirmed that the humid conditions have a prominent influence on the head blight and the development of undesirable wheat grains. It is evident from the present findings that the minimum of 5 days continuous humid conditions after the plant infection at anthesis stage is very congenial for wheat head blight development due to *Bipolaris sorokiniana*. The grain quality drastically deteriorates when the moist condition prolongs beyond 5 days.

CONCLUSION

The head and leaf blight severity are increased and grain quality drastically deteriorates when the crop infested by *Bipolaris sorokiniana* coupled with prolonged period of high relative humidity in the field.

LITERATURE CITED

- Bazlur Rashid, A. Q. M. and Fakir, G. A. 1998. A press briefing on leaf blight of wheat. Held on 28 March 1998 at Seed Pathology Center, Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh-2202.
- Bazlur Rashid, A. Q. M. and Fakir, G. A. 2000. Seed Pathology Laboratory Research Report on the Survey of *Bipolaris* Leaf Blight Epidemic in Bangladesh. Seed Pathology Center, Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh-2202.
- Bazlur Rashid, A. Q. M., Meah, M. B. and Jalaluddin, M. 1987. Effect of leaf blight caused by *Drechslera sorokiniana* (Sacc.) Subram. and Jain. on some yield components of wheat. *Crop protection* **6**, 256-260.
- Bazlur Rashid, A. Q. M. 1998. Effect of seed transmitted *Bipolaris sorokiniana* on the growth and survival of wheat seedlings. *Indian Phytopath* **51**, 329-333.
- Fakir, G. A., Khan, A. L., Neergaard, P. and Mathur, S. B. 1977. Transmission of *Drechslera* spp. through wheat seed in Bangladesh. *Bangladesh J Agric* **1**, 113-118.
- Gilchrist, L. I. 1985. CIMMYT Methods for Screening Wheat for *Helminthosporium sativum* Resistance. In "Wheat for More Tropical Environment". A proceedings of the International Symposium, Sponsored by: The United Nations Development Programme and CIMMYT, 24-28 September 1984, Mexico. pp.149-151.
- Hossain, I. and Azad, A. K. 1992. Reaction of wheat to *Helminthosporium sativum* in Bangladesh. *Hereditas* **116**, 203-205.
- Randhawan, H. S. and Sharma, H. L. 1985. Detection and distribution of *Cochliobolus sativus* on wheat seed in the Punjab State. *Indian Phytopath* **38**, 341-343.
- Singh, R. S. 1984. Assessment of disease incidence and loss. In "Introduction to the Principles of Plant Pathology" (3rd Edn.), Oxford and IBH Publishing Company, New Delhi.