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REACTION OF BARLEY GENOTYPES TO *Bipolaris sorokiniana*

M. M. RAHMAN[1], A. K. M. M. ALAM[2], N. NAHER[3]
S. M. SHARIFUZZAMAN[4] AND M. A. N. UDDIN[5]

Abstract

A study on response of 29 barley genotypes resistant to Bipolaris leaf blight *(Bipolaris sorokiniana)* was conducted to investigate the relationship of the components of resistance of 29 barley genotypes. Data on five components of resistance viz., infection frequency (number of lesions per plant), lesion size (mm^2), percent leaf area affected by lesion, percent necrotic area on leaf, and disease severity were recorded as components of resistance. The genotypes fall into four clusters. Cluster I was to be the largest having 11 genotypes which was followed by cluster III, IV, and II. Considering the overall mean performances of different clusters, genotypes of cluster II showed better performance against resistance. From the cannonical variate analysis, it was found that three components like lesion size, necrosis, and 100-seed weight were found positive for the both vector, and these characters contributed maximum towards the divergence for disease development of the barley accessions.

Keywords: *Bipolaris sorokiniana,* barley, leaf blight

Introduction

Barley is the world's, fourth most important cereal after wheat, rice, and maize (Alam *et al.,* 2006). It can be grown in drought prone areas as well as saline areas of Bangladesh. The crop is affected by several diseases. Among them, Bipolaris leaf blight (BpLB) caused by *Bipolaris sorokiniana* is the most severe one. About 23% yield loss at farmer's field has been reported by Dubin and Ginkel (1991). Cultivation of resistant varieties is considered to be the cheapest way to combat BpLB. To develop such varieties, it is necessary to be considered components of resistance. Development of a fungal disease on a host plant depends on the ability of the pathogen to cause infection and production of symptoms. Although a significant progress has been made to obtain genotypes resistant to leaf rust, it is scanty on leaf blight, which is a major constraint to production in South Asia. In plants, pathotoxin plays critical role in the development of diseases and also help determine the host range as well as the parasitic ability of pathogen. Germination of inoculum, penetration of germ tube and colonization of host tissues are main events of infection. Resistance of leaf blight of wheat caused by *Septoria nodorum* are measured based on incubation period, infection frequency (Spores/cm^2), latent period, lesion size, lesion cover,

[1]Plant Pathology Division, Bangladesh Agricultural Research Institute (BARI), [2]Pulses Research Centre (BARI), [3]Agricultural Botany Department, PSTU, [4]HRC (BARI), Gazipur 1701, [5]Assistant Commisionar, Satkhira District, Bangladesh.

necrosis, and spore (Jeger *et al.,* 1983; Cunfer *et al.,* 1988). Components of BpLB on barley have not yet been studied in Bangladesh. Therefore, the present study was undertaken to investigate the components of resistance of the disease on seedlings of 29 barley genotypes and to classify them into genotypic groups based on those components.

Materials and Method

The experiment was conducted in the field of Plant Breeding Division, Bangladesh Agricultural Research Institute (BARI), Gazipur during *rabi* 2006-2007 with 29 genotypes. The experiment was in RCB design with three replications. Row to row spacing was 40 cm with continuous sowing. Each entry was 4 rows 2m long. A virulent isolate *of Bipolaris sorokiniana* was collected from the stock culture of Plant Pathology Division, BARI. At three-leaf stage, the seedlings were inoculated with freshly prepared *B. sorokiniana* conidial suspension containing 3,0000 spores/ml. Conidia were collected from 10 days old culture and Tween 20 was added to the suspension at 1 ml/litre to prohibit the spores from clustering. After inoculation, the seedlings were covered by a polyethylene for 72 hrs to ensure humidity. After 72 hrs of inoculation, data on five components of resistance viz. infection frequency (number of lesions per plant), lesion size (mm^2), percent leaf area affected by lesion, percent necrotic area on leaf, and disease severity (Mian, 1995) were recorded. Disease severity was indexed at 0-5 scale (Alam and Gustafson, 1988). Data on yield contributing characters were recorded from ten randomly selected plants and analyzed statistically. Genetic diversity in the barley accessions was analyzed following multivariate analysis. The techniques used in multivariate analysis were Principal component analysis, Principal coordinate analysis, Cluster analysis, and Canonical variate analysis. The multivariate analysis was performed using GENSTAT computer program.

Results and Discussion

Mean and ranges of eight components of resistance i.e., BpLB development, namely infection frequency (IF) in terms of spot number per leaf, lesion size (LS), lesion cover (LC), necrosis (NC), disease severity (DI), days to maturity, 100-seed weight, and yield per plant are presented in Table 1. The mean values of the above parameters were 15.13/leaf, 0.80mm^2, 21.16%, 60.50%, 2.31, 106.0, 3.75g and 6.85g, respectively. Analysis of variance indicated that barley genotypes differed significantly based on lesion cover, necrosis, disease severity, days to maturity, and yield per plant. Each component contributes significantly to the severity of the disease. A resistant genotype must possess capacity to resist development of each of the components to designate it as a resistant material. The findings indicate that IF, LS, LC, and NC are required to be considered at the

time of development of barley varieties resistant to *B. sorokiniana* because these are important components of resistance. Jeger *et al.* (1983) and Cunfer *et al.* (1988) also considered the above parameters as important component of resistance of wheat to leaf spotting pathogen.

Table 1. Ranges and means of seven components of Bipolaris leaf blight *(Bipokaris sorokiniana)* on 29 wheat genotypes.

Components	Range	Mean	F test[1]
Infection frequency (no. of spores)	1.00-110	18.13+18.95	NS
Lesion size (mm^2)	0.50-3.0	0.80-+0.242	NS
Lesion cover (LS) (% area covered)	0.50-80.0	24.16+19.193	**
Necrosis (NC) (% area covered)	3.00-100.0	62.38+31.64	**
Disease index (DI) (0-5 scale)	1.00-3.83	2.31+0.544	**
Days to maturity .	105-108	106+0.85	**
100-seed wt (g)	3.5-4.0	3.85+0.15	NS
Yield/plant(g)	5.5-8.6	6.85+0.57	* *

** significant at 5% level, NS = Not Significant

Classification of wheat genotypes

The analysis of variance showed differences among the genotypes for the characters under study. Thirty nine genotypes were grouped into four clusters. The genotypes fall into four clusters indicating the lower order of diversity. Cluster I was to be the largest having 16 genotypes which was followed by cluster III, IV, and II (Table 2).

Table 2. Distribution of 29 barley genotypes for resistant to Bipolaris leaf blight *(Bipolaris sorokiniana)*.

Cluster No.	No. of genotypes	Genotypes
1	11	4,5,8,10,11,12,13,16,18,19,20,25
II	6	2,3,9,17,21,22
III	9	6, 7, 14, 15, 24, 26, 27, 28
IV	5	1,23,29

Inter-cluster and intra-cluster distance

The inter-cluster and Intra-cluster distance (D^2) obtained from cluster analysis is presented in Table 3. The intra cluster distances range from 1.82 to 3.42. The Inter-cluster distance between cluster Ill and I was maximum followed by the distances between clusters IV and I. The distances between cluster I and II, and II and III were 3.42 and 2.13, respectively. The lower distance was observed

between clusters III and II. Minimum Intra-cluster distance of 1.82 was found in cluster III and the maximum was in cluster I followed by cluster IV. The intra cluster distance was lower than the inter cluster distance indicating the lower order of diversity due to similarity of parentage. Simillar results were also obtained by Alam *et al.* (2006). In case of inter cluster distances, highest distances were observed in cluster II and III, which was followed by cluster III and IV.

Table 3. Means inter-cluster and intra-cluster (bold) distance (D^2) for 29 accessions of barley inoculated with Bipolaris leaf blight *(Bipolaris sorokiniana)*.

Cluster	I	II	III	IV
I	**3.42**	5.33	12.38	9.80
II		**2.13**	8.06	*6.58*
III			**1.82**	4.66
IV				**2.90**

Contribution of different components

Cluster mean values of different components of resistance to 29 barley accessions are presented in Table 4. All clusters had almost similar means for disease severity, which indicates that components did not contribute greatly to the diversity in barley accessions. Great variation was observed in means of other components under different clusters.

Table 4. Cluster means for eight components of resistance in barley to *Bipolaris sorokiniana.*

Components	Cluster			
	I	II	III	IV
Infection frequency	24.2	13.9	18.3	15.5
Lesion size (mm^2)	1.0	0.7	0.9	0.8
Lesion cover (%)	17.58	12.39	15.2	26.8
Necrosis (%)	59.30	51.20	63.00	67.8
Disease severity (0-5 scale)	2.0	1.8	2.2	2.5
Days to maturity	106	105	107	108
100-seed wt (g)	3.5	5.5	4.45	5.0
Yield/plant (g)	6.2	8.2	7.6	5.65

Considering overall mean performances, cluster II has the lowest values for components of resistance i.e., BpLB development, namely infection frequency (IF) in terms of spot number per leaf, lesion size (LS), lesion cover (LC), necrosis (NC), disease severity (Dl), and higher values of yield attributes e.g.100-

seed weight, yield per plant, and maturity. These indicate that early maturity and high yielding genotypes are included in this group. Endang *et al.* (1971) stated that clustering pattern could be utilized to generate variability for various important characters. Cluster I, III, and IV are characterized by a high necrosis, which is an important component of disease resistance. It indicates that necrosis is a major contributor to the diversity of barley accessions and accessions from cluster II may be selected as parent material for future breeding programme for resistant variety development.

The cannonical variate analysis showed that in vector I and lesion size, necrosis and disease severity scale were positive (Table 5). In case of vector II, all the components except lesion cover and yield per plant were found positive. However, four components like lesion size, necrosis, disease severity, and 100-seed weight were found positive for the both vectors and these characters contributed maximum towards the divergence for disease development of the barley accessions. Tomooka (1991) stated that evaluation of genotypes is important to know the sources of genes for particular trait within available germplasms.

Table 5. Latent vectors for seven components of resistance in barley to *Bipolaris sorokiniana.*

Principal components axis	Vector I	Vector II
Infection frequency	-0.0154	0.5123
Lesion size(mm^2)	1.3621	0.8467
Lesion cover (%)	-0.3367	-0.0214
Necrosis (%)	0.2154	1.0136
Disease severity (0-5 scale)	0.1107	-0.0986
Days to maturity	-0.6354	0.5120
100-seed wt (g)	1.3968	0.5897
Yield/plant (g)	0.4565	-0.8164

The components assessed in the present study showed associated variation. Increased levels of infection frequency, lesion size, lesion cover, and necrosis are important components for higher degree of severity of BpLB. Based on the findings of the present study, it may be concluded that infection frequency, lesion size, lesion cover, and necrosis are important components of resistance of barley to *Bipolaris sorokiniana.* These components should be considered at the time of resistant variety development in barley against BpLB.

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